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PRACTICAL
ORTHODONTIA

BY

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College; President of The Dewey School of Orthodontia

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TO

EDWARD H. ANGLE, M.D., D.D.S.,

IN RECOGNITION OF THE INSPIRATION AND HELP

DERIVED FROM HIM

IN MY EARLY DAYS IN ORTHODONTIA

THIS VOLUME IS RESPECTFULLY DEDICATED

BY THE AUTHOR

PREFACE.

Believing that there should be a book more suited to the needs of the student of orthodontia than any which we now have, the author has attempted to include in this volume certain principles which he has found to partially fulfill, at least, the needs of his students.

Occlusion being the basis of orthodontia, much space has been devoted to the different forces of occlusion, and there has also been added a table giving the occlusion of each of the inclined planes of the teeth.

Classification has been based on the mesio-distal relation of the teeth, and since Angle's plan of nomenclature appears to be the one most universally used, it has been adhered to. Under classification certain types have been included which are so different as to require a different technique in treatment.

Causes of malocclusion have been taken up under different headings and described.

Under appliances, the author has confined his discussion to those which have proven their worth and which he believes will be successful in the greatest number of cases. The principles of retention have been carefully explained, for undoubtedly much unnecessary trouble has resulted in the past by not taking into consideration the principles involved.

It has been the aim of the author to confine his discussion to the practical side of the question rather than to the historical features. Very little has been said about art as related to orthodontia. Neither has he dwelt upon the histological side of tooth movement or the development of bone, as these subjects should be taught by the chair of histology. Mention has been made of only such appliances as would be in keeping with physiological tooth movement and bone growth. The author has purposely omitted any reference to the disputed question of opening the suture as an aid to orthodontic treatment. These questions are still unsettled and therefore should not be incorporated in a work of this kind to confuse the student. Since a great many methods pertaining to orthodontia have been advanced by different authorities in the past, and as priority is often a matter of dispute, the author has not attempted to give credit for everything; neither does he claim originality for anything contained herein. While he has done certain things and advanced certain theories which were new to him at one time, others have done the same twenty years ago.

Lastly, this book is not supposed to be the final solution of all things pertainting to orthodontia, but is intended for those interested in the subject who may be helped as a result of some of the author's experience gained during a period of twelve years as a teacher of orthodontia.

M. D.

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PRACTICAL ORTHODONTIA

CHAPTER I.

OCCLUSION.

Orthodontia is that science which has for its object the correction of malocclusion of the teeth.

Malocclusion is a deviation from the normal to such an extent as to interfere with the functions of the teeth.

Normal occlusion is the relation of the inclined planes of the teeth as intended by nature.

Occlusion is the relation of the inclined planes of the teeth.

Orthodontia, being that science which deals with the malocclusion of the teeth, it necessarily follows that a study of this subject includes a thorough understanding of the teeth as arranged by nature (Fig. 1). Each one of the teeth has a definite position in the dental arch, not only with the teeth of each individual arch, but also with those of the opposing arch (Fig. 2). To recognize malocclusion it is necessary that we be familiar with normal occlusion. Not only has each tooth a definite and positive relation with the tooth of the opposite arch, but each inclined plane of each cusp has a certain relation with the inclined plane of some other cusp. By a study of the anatomy of the teeth, we find each cusp to be made up and bounded by marginal ridges and developmental ridges and grooves. These ridges and grooves also separate the cusps into definite inclined planes.

The occlusal inclined planes of the teeth are named from the surfaces toward which they face, and their names

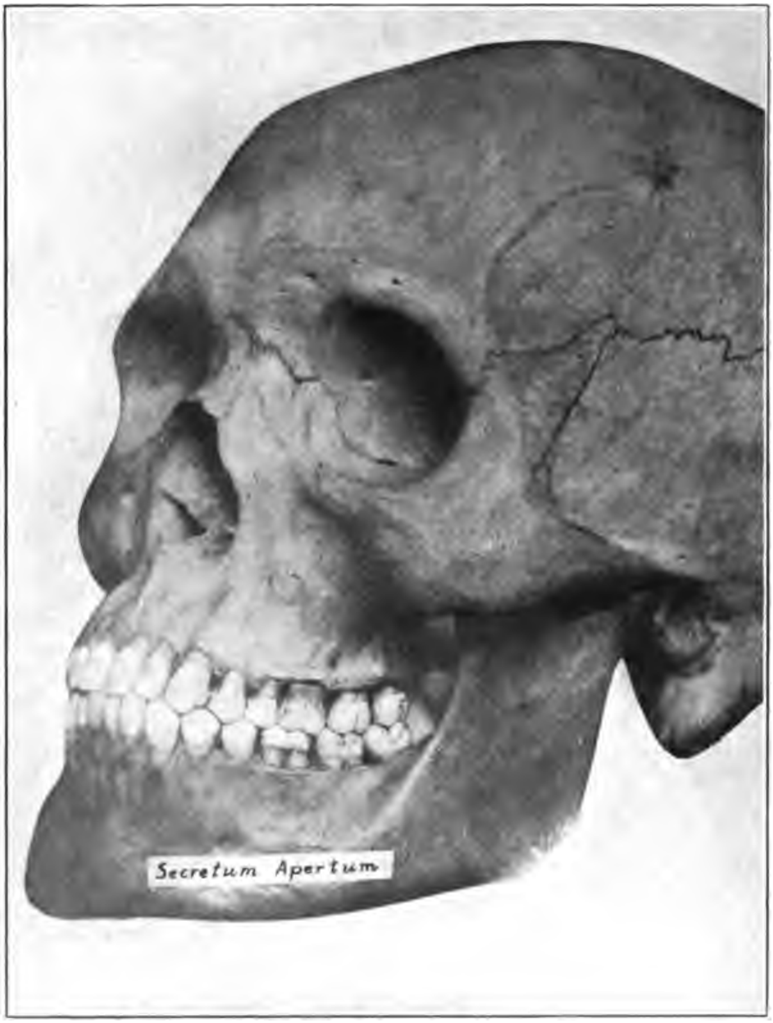

Fig. 1.
Normal occlusion of teeth.

are derived from a combination of the four terms, mesial, distal, buccal, and lingual (Fig. 3). In study-

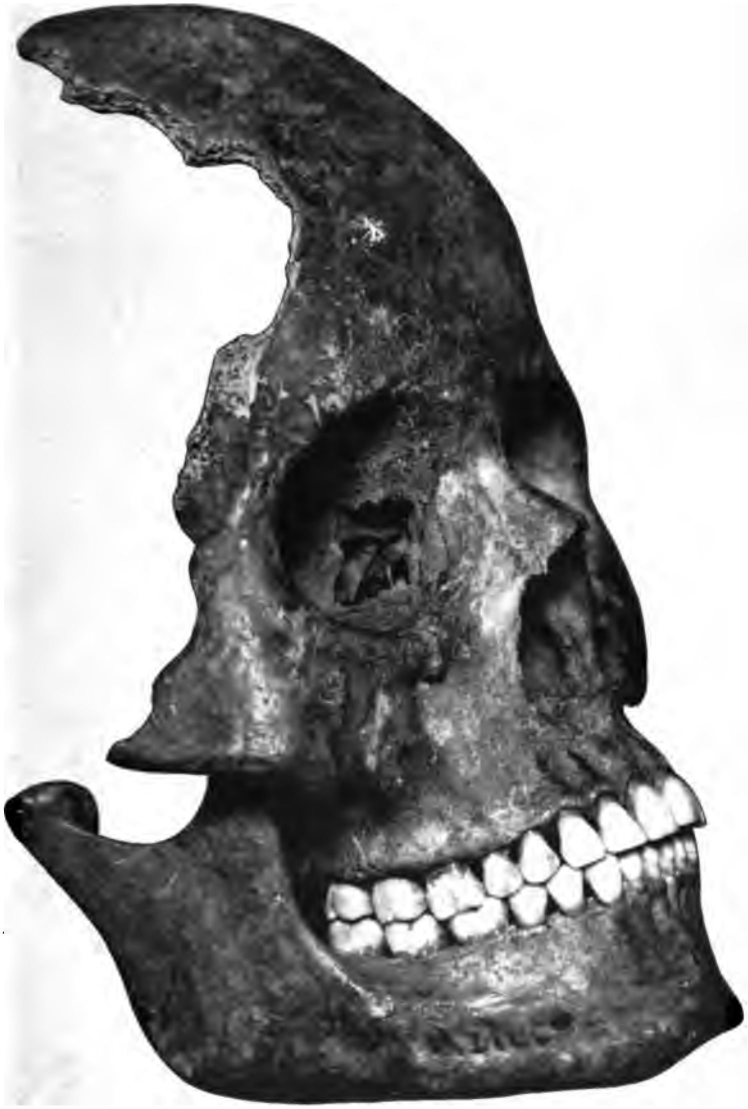

Fig. 2.
Normal occlusion. (Aztec skull.)

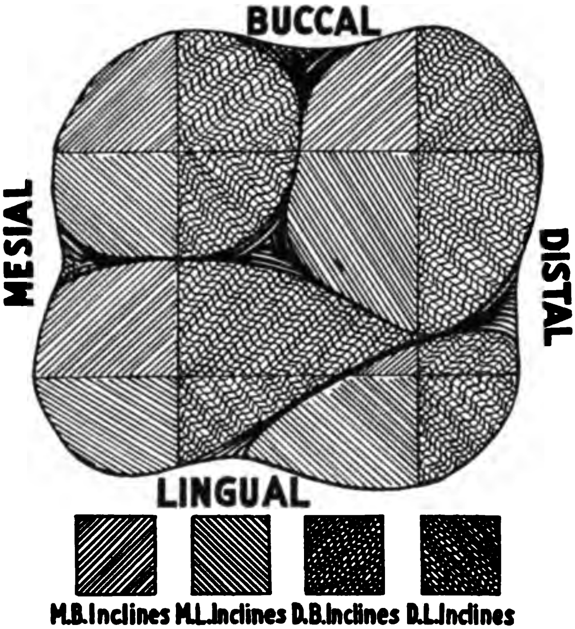

Fig. 3.
Showing occlusal inclined planes of the cusps.

ing the arrangement of the teeth we find that the lower teeth are set one inclined plane in advance of the upper teeth. This is made possible because the lower central incisor is narrower than the upper central incisor. When

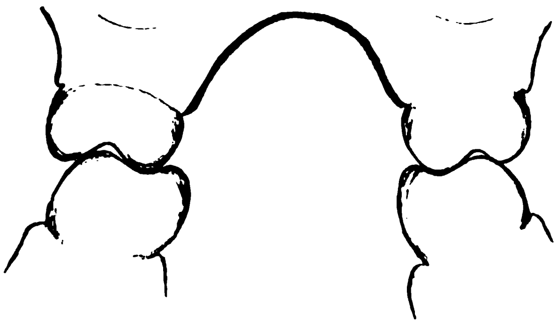

Fig. 4.
Buccal and lingual relation of molars.

we reach the upper canine, we find that the upper canine occludes with the lower canine and a portion of the lower first premolar. Passing from the buccal to the lingual, we find that the upper teeth are one-half of a cusp to the buccal of the lower teeth (Fig. 4); that is, the lingual cusps of the upper molars and premolars occlude between the buccal and lingual cusps of the lower molars and premolars (Fig. 5). The buccal cusps of the lower molars and premolars occlude between the buccal and lingual cusps of the upper molars and premolars. By studying Figs. 1, 2, 4 and 5 some idea can be gained of their arrangement. Probably a much better idea can be obtained by studying the diagram shown in Fig. 6.

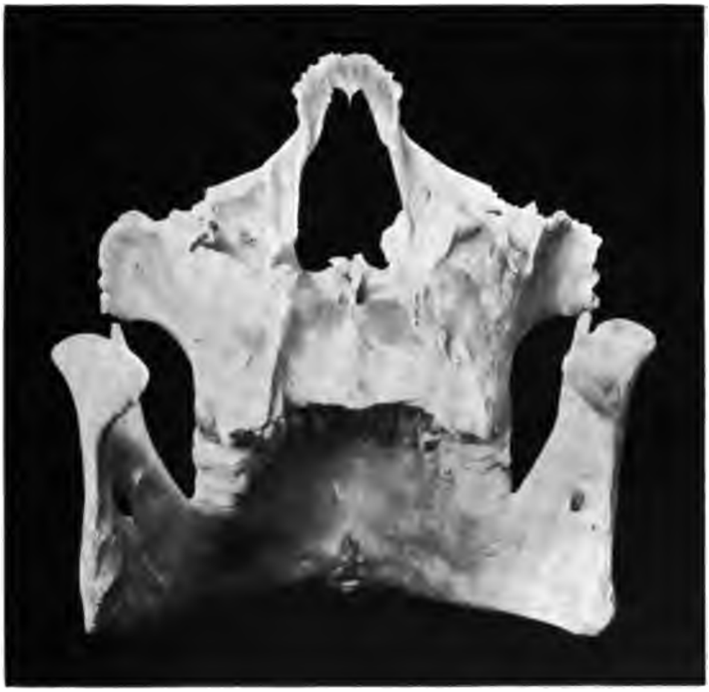

Fig. 5.
Shows relation of lingual cusps of upper molar to lower.

It becomes apparent that the inclined planes of the teeth are necessarily arranged diagonally to the mesio-distal relation of the arches. They are named mesio-buccal, mesio-lingual, disto-buccal and disto-lingual. A point to be remembered in studying the occlusion of the teeth is the mesio-buccal cusp of the upper first molar which occludes in the buccal groove of the lower first

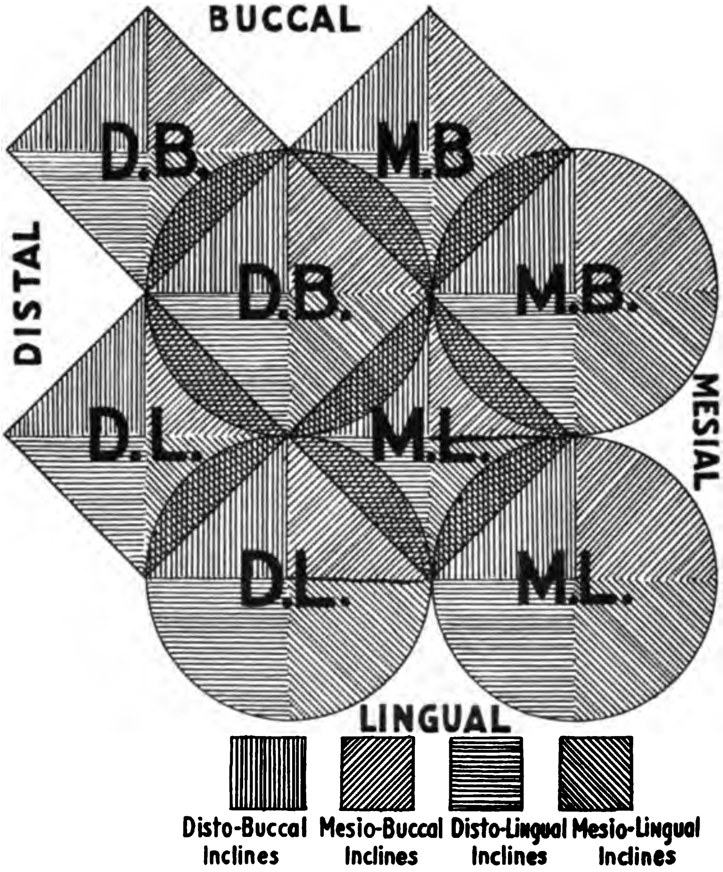

Fig. 6.

Shows relation of cusps and inclined planes. Upper cusps, square; lower cusps, round. Note position of mesio-lingual cusp of upper molar and disto-buccal cusp of lower.

molar. This arrangement is found on all of the molar teeth. The mesio-lingual cusps of the upper molars occlude in the central fossæ of the corresponding lower molars. The mesio-lingual cusp of the upper molar is

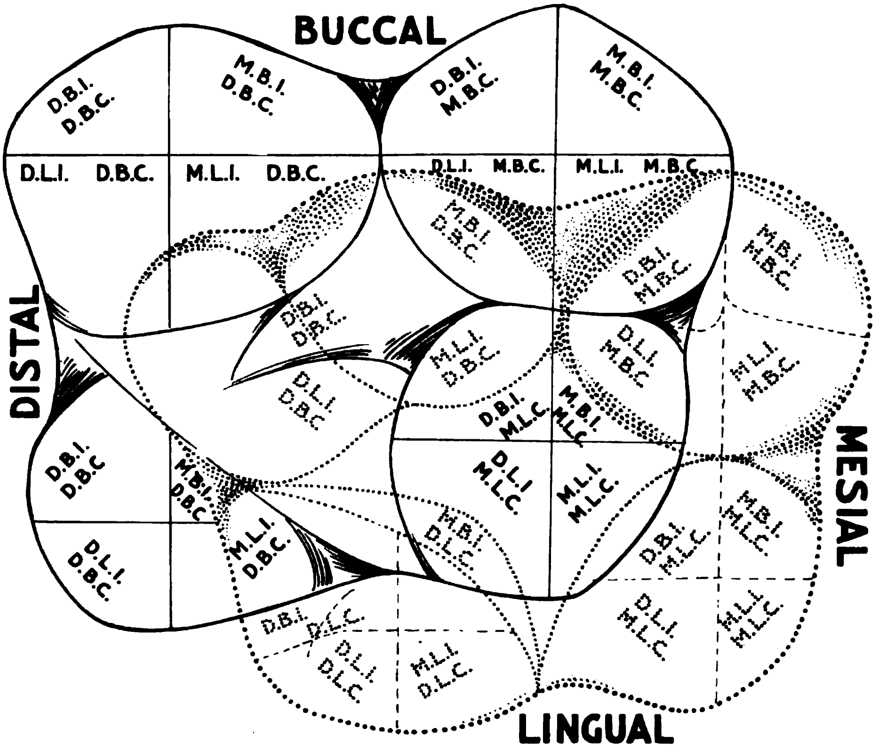

Fig. 6-A.

Upper and lower molar, showing mesio-lingual cusp in central fossa of lower molar. Initial letters of cusps and inclines used; e. g., M.B.I.—D.B.C. refers to mesio-buccal of disto-buccal cusp.

surrounded by the four cusps of the corresponding lower molar. The disto-buccal cusp of the lower molar occludes in the corresponding central fossa of the upper molar, which makes the disto-buccal cusps of the lower molars surrounded by the four cusps of the corresponding upper molars. However, in the case of the lower first molar which has a disto-buccal and distal cusp, the arrangement is a little different; but ordinarily we consider the disto-buccal and distal cusp as one cusp. Another thing to remember is that the lingual surface of the lingual cusps of the lower molars and premolars are also without occlusion.

The occlusion of the inclined planes of the upper teeth with the lower is given in the following table. The left-hand column contains cusps of the upper teeth, while the right-hand column refers to the lower teeth. By reading the left-hand column first we are given the occlusion of the upper teeth with the lower, and by reading the right-hand column first we are given the occlusion of the lower teeth with the upper. It is necessary that they who expect to treat malocclusion must know the relation of the inclined planes of each cusp or it will be absolutely impossible to correctly diagnose and treat malocclusion of the teeth.

TABLE SHOWING OCCLUSION OF INCLINED PLANES.

UPPER TEETH		LOWER TEETH
The occlusal lingual third of the upper first (central) incisor.	occludes with	the labial occlusal third of the lower first (central) incisor and the mesio-labial half of the occlusal surface of the lower second (lateral) incisor.
The occlusal lingual third of the upper second (lateral) incisor.	occludes with	the disto-labial occlusal surface of the lower second (lateral) incisor and the mesio-labial incline of the lower canine (cuspid).
The mesio-lingual inclined plane of the upper canine (cuspid)	occludes with	the disto-buccal inclined plane of the lower canine (cuspid).
The disto-lingual inclined plane of the upper canine (cuspid)	occludes with	the mesio-buccal inclined plane of the buccal cusp of the lower first premolar (bicuspid).

UPPER TEETH		LOWER TEETH
The mesio-lingual inclined plane of the buccal cusp of the upper first premolar (bicuspid)....	occludes with	the disto-buccal inclined plane of the buccal cusp of the lower first premolar (bicuspid).
The disto-lingual inclined plane of the buccal cusp of the upper first premolar (bicuspid)....	occludes with	the mesio-buccal inclined plane of the buccal cusp of the lower second premolar (bicuspid).
The mesio-buccal inclined plane of the lingual cusp of the upper first premolar (bicuspid).	occludes with	the disto-lingual inclined plane of the buccal cusp of the lower first premolar (bicuspid).
The mesio-lingual inclined plane of the lingual cusp of the upper first premolar (bicuspid).	occludes with	the disto-buccal inclined plane of the lingual cusp of the lower first premolar (bicuspid). (This cusp is often underdeveloped.)
The disto-buccal inclined plane of the lingual cusp of the upper first premolar (bicuspid).	occludes with	the mesio-lingual inclined plane of the buccal cusp of the lower second premolar (bicuspid).
The disto-lingual inclined plane of the lingual cusp of the upper first premolar (bicuspid).	occludes with	the mesio-buccal inclined plane of the lingual cusp of the lower second premolar (bicuspid).
The mesio-lingual inclined plane of the buccal cusp of the upper second premolar (bicuspid)..	occludes with	the disto-buccal inclined plane of the buccal cusp of the lower second premolar (bicuspid).
The disto-lingual inclined plane of the buccal cusp of the upper second premolar (bicuspid)..	occludes with	the mesio-buccal inclined plane of the mesio-buccal cusp of the lower first molar.
The mesio-buccal inclined plane of the lingual cusp of the upper second premolar (bicuspid)	occludes with	the disto-lingual inclined plane of the buccal cusp of the lower second premolar (bicuspid).
The mesio-lingual inclined plane of the lingual cusp of the upper second premolar (bicuspid)	occludes with	the disto-buccal inclined plane of the lingual cusp of the lower second premolar (bicuspid).
The disto-buccal inclined plane of the lingual cusp of the upper second premolar (bicuspid)	occludes with	the mesio-lingual inclined plane of the mesio-buccal cusp of the lower first molar.
The disto-lingual inclined plane of the lingual cusp of the upper second premolar (bicuspid)	occludes with	the mesio-buccal inclined plane of the mesio-lingual cusp of the lower first molar.

UPPER TEETH		LOWER TEETH
The mesio-lingual inclined plane of the mesio-buccal cusp of the upper first molar.........	occludes with	the disto-buccal inclined plane of the mesio-buccal cusp of the lower first molar.
The disto-lingual inclined plane of the mesio-buccal cusp of the upper first molar.........	occludes with	the mesio-buccal inclined plane of the disto-buccal cusp of the lower first molar.
The mesio-buccal inclined plane of the mesio-lingual cusp of the upper first molar.........	occludes with	the disto-lingual inclined plane of the mesio-buccal cusp of the lower first molar.
The mesio-lingual inclined plane of the mesio-lingual cusp of the upper first molar.........	occludes with	the disto-buccal inclined plane of the mesio-lingual cusp of the lower first molar.
The disto-buccal inclined plane of the mesio-lingual cusp of the upper first molar.........	occludes with	the mesio-lingual inclined plane of the disto-buccal cusp of the lower first molar.
The disto-lingual inclined plane of the mesio-lingual cusp of the upper first molar.........	occludes with	the mesio-buccal inclined plane of the disto-lingual cusp of the lower first molar.
The mesio-lingual inclined plane of the disto-buccal cusp of the upper first molar.........	occludes with	the disto-buccal inclined plane of the disto-buccal cusp of the lower first molar.
The disto-lingual inclined plane of the disto-buccal cusp of the upper first molar.........	occludes with	the mesio-buccal inclined plane of the mesio-buccal cusp of the lower second molar.
The mesio-buccal inclined plane of the disto-lingual cusp of the upper first molar.........	occludes with	the disto-lingual inclined plane of the disto-buccal cusp of the lower first molar.
The mesio-lingual inclined plane of the disto-lingual cusp of the upper first molar.........	occludes with	the disto-buccal inclined plane of the disto-lingual cusp of the lower first molar.
The disto-buccal inclined plane of the disto-lingual cusp of the upper first molar.........	occludes with	the mesio-lingual inclined plane of the mesio-buccal cusp of the lower second molar.
The disto-lingual inclined plane of the disto-lingual cusp of the upper first molar.........	occludes with	the mesio-buccal inclined plane of the mesio-lingual cusp of the lower second molar.

UPPER TEETH		LOWER TEETH
The mesio-lingual inclined plane of the mesio-buccal cusp of the upper second molar.......	occludes with	the disto-buccal inclined plane of the mesio-buccal cusp of the lower second molar.
The disto-lingual inclined plane of the mesio-buccal cusp of the upper second molar.......	occludes with	the mesio-buccal inclined plane of the disto-buccal cusp of the lower second molar.
The mesio-buccal inclined plane of the mesio-lingual cusp of the upper second molar.......	occludes with	the disto-lingual inclined plane of the mesio-buccal cusp of the lower second molar.
The mesio-lingual inclined plane of the mesio-lingual cusp of the upper second molar.......	occludes with	the disto-buccal inclined plane of the mesio-lingual cusp of the lower second molar.
The disto-buccal inclined plane of the mesio-lingual cusp of the upper second molar.......	occludes with	the mesio-lingual inclined plane of the disto-buccal cusp of the lower second molar.
The disto-lingual inclined plane of the mesio-lingual cusp of the upper second molar.......	occludes with	the mesio-buccal inclined plane of the disto-lingual cusp of the lower second molar.
The mesio-lingual inclined plane of the disto-buccal cusp of the upper second molar.......	occludes with	the disto-buccal inclined plane of the disto-buccal cusp of the lower second molar.
The disto-lingual inclined plane of the disto-buccal cusp of the upper second molar.......	occludes with	the mesio-buccal inclined plane of the mesio-buccal cusp of the lower third molar.
The mesio-buccal inclined plane of the disto-lingual cusp of the upper second molar.......	occludes with	the disto-lingual inclined plane of the disto-buccal cusp of the lower second molar.
The mesio-lingual inclined plane of the disto-lingual cusp of the upper second molar.......	occludes with	the disto-buccal inclined plane of the disto-lingual cusp of the lower second molar.
The disto-buccal inclined plane of the disto-lingual cusp of the upper second molar.......	occludes with	the mesio-lingual inclined plane of the mesio-buccal cusp of the lower third molar.
The disto-lingual inclined plane of the disto-lingual cusp of the upper second molar.......	occludes with	the mesio-buccal inclined plane of the mesio-lingual cusp of the lower third molar.

UPPER TEETH		LOWER TEETH
The mesio-lingual inclined plane of the mesio-buccal cusp of the upper third molar........	occludes with	the disto-buccal inclined plane of the mesio-buccal cusp of the lower third molar.
The disto-lingual inclined plane of the mesio-buccal cusp of the upper third molar........	occludes with	the mesio-buccal inclined plane of the disto-buccal cusp of the lower third molar.
The mesio-buccal inclined plane of the mesio-lingual cusp of the upper third molar........	occludes with	the disto-lingual inclined plane of the mesio-buccal cusp of the lower third molar.
The mesio-lingual inclined plane of the mesio-lingual cusp of the upper third molar........	occludes with	the disto-buccal inclined plane of the mesio-lingual cusp of the lower third molar.
The disto-buccal inclined plane of the mesio-lingual cusp of the upper third molar........	occludes with	the mesio-lingual inclined plane of the disto-buccal cusp of the lower third molar.
The disto-lingual inclined plane of the mesio-lingual cusp of the upper third molar........	occludes with	the mesio-buccal inclined plane of the disto-lingual cusp of the lower third molar.
The mesio-lingual inclined plane of the disto-buccal cusp of the upper third molar........	occludes with	the disto-buccal inclined plane of the disto-buccal cusp of the lower third molar.
The disto-lingual inclined plane of the disto-buccal cusp of the upper third molar........	occludes with	nothing.
The mesio-buccal inclined plane of the disto-lingual cusp of the upper third molar........	occludes with	the disto-lingual inclined plane of the disto-buccal cusp of the lower third molar.
The mesio-lingual inclined plane of the disto-lingual cusp of the upper third molar........	occludes with	the disto-buccal inclined plane of the disto-lingual cusp of the lower third molar.
The disto-buccal inclined plane of the disto-lingual cusp of the upper third molar........	occludes with	nothing.
The disto-lingual inclined plane of the disto-lingual cusp of the upper third molar........	occludes with	nothing.

NOTE.—The author prefers the terms *first* and *second* incisors to *central* and *lateral* as being in keeping with first and second molars, etc. The terms *canines* and *premolars* are also more scientific and descriptive than *cuspids* and *bicuspids*. To avoid confusion both terms are given in the table.

The tip of the lingual cusp of the upper premolar does not occlude between the lower premolars but occludes in the distal portion of the central fossa of the lower first premolar. The tip of the lingual cusp of the upper second premolar occludes in the distal portion of the central fossa of the lower second premolar.

The upper premolars are so placed in the upper arch that a line drawn through the buccal and lingual cusps of the right premolars would also touch the buccal and lingual cusps of the corresponding teeth on the left side.

The lower premolars are so placed that lines drawn through the buccal and lingual cusps of the right and left teeth would cross at almost a right angle at a point distal to the teeth.

CHAPTER II.

FORCES OF OCCLUSION.

It has been shown that each cusp has a definite relation to the opposing cusp, which relation we have termed "occlusion." Each tooth is held in a proper position by what we call "forces of occlusion."

Definition.—Forces of occlusion are those factors which cause teeth to assume and maintain their proper position in the line of occlusion.

Line of Occlusion.—The line of occlusion is that line with which, in form and position according to type, the teeth must be in harmony if in normal occlusion (Angle). The line of occlusion can also be defined as the line of the greatest occlusal contact. As each tooth begins to make its appearance from the dental crypt and gum it is guided to a certain position in the dental arch. If all of the forces of occlusion are acting normally the tooth will take its proper position, and if the same forces of occlusion act normally during the time that the entire dental apparatus is forming, all of the teeth will be in their proper positions. However, should one of the forces of occlusion become abnormal the result will be malocclusion. Any one of the teeth failing to take the proper position in the line of occlusion will influence some other tooth or teeth and malocclusion will result.

Classification of Forces of Occlusion.

There are six forces of occlusion, as follows:

1. Normal cell metabolism.
2. Muscular pressure.

3. Force of the inclined plane.
4. Normal approximal contact.
5. Harmony in the size of the arches.
6. Atmospheric pressure.

Normal Cell Metabolism.—Because normal cell metabolism is given first, does not necessarily mean that it is the most important, for we cannot have any one of the forces of abnormal and still have normal occlusion of the teeth. These forces are given as near as possible in the order that they make their appearance during the time the dental apparatus is developing.

Normal cell metabolism may be defined as the proper physiological development of the cells which have to do with the eruption of the teeth and the development of the surrounding parts. If a child is developing normally (Fig. 7), we will have calcifications at the end of the tooth germ, causing an increase in the length of the root and absorption of the bone forming the dental crypt and the development of the peridental membrane. In fact, it is the cell activity of that particular region which causes the tooth to erupt. Therefore, cell metabolism is the first force which causes the teeth to assume the proper position in the dental arch.

Muscular Pressure.—It also generally follows that teeth, when they first erupt, do not always occupy their proper position. They may be too far to the buccal or lingual side of the arch. However, the second force of occlusion, muscular pressure, aids the tooth to take very nearly the proper position in regard to the buccal and lingual relation to the line of occlusion. Should the central incisor erupt too far to the lingual, the pressure of the tongue will force it labially. Should it be too far to the labial, the pressure of the lips will force it lin-

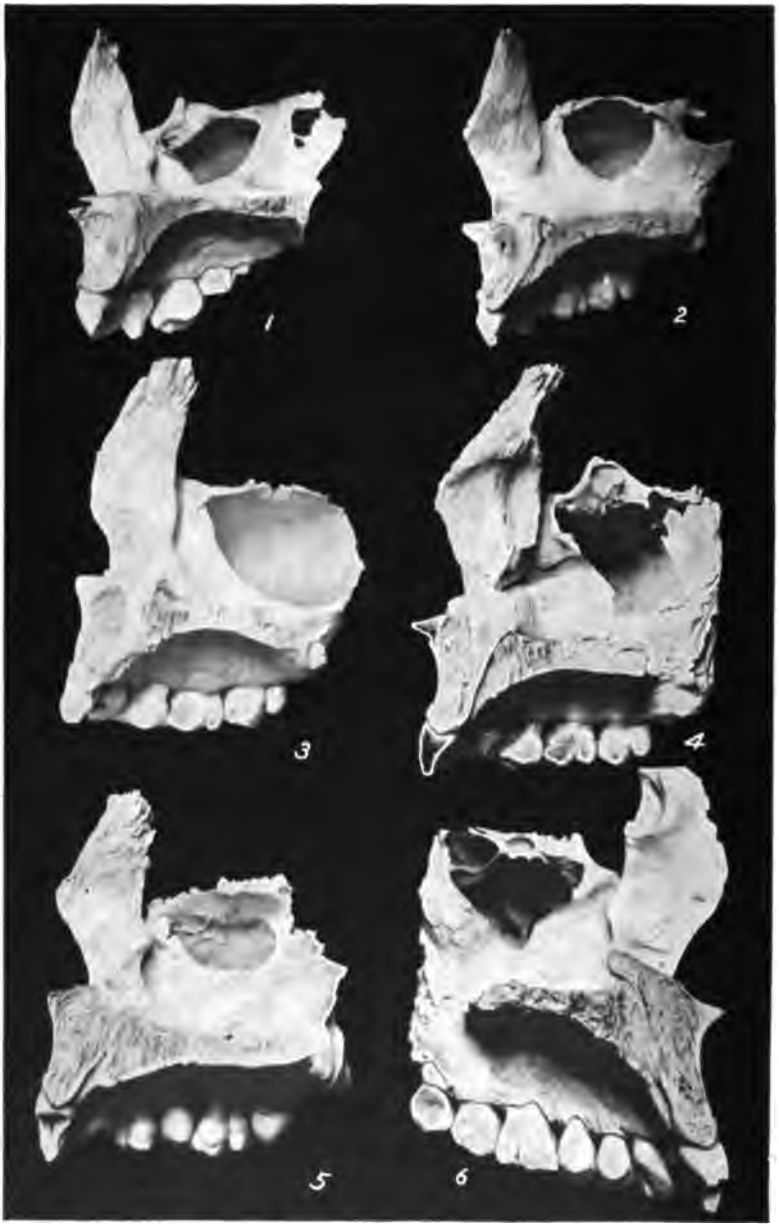

Fig. 7.
Half of the superior maxilla, showing the growth downward and forward of the alveolar process and palate. (After Noyes.)

gually. As a result of the activity of the muscles of the cheeks and tongue, we find that each one of the deciduous teeth are caused to assume a position in the arch in response to those forces. Therefore, muscular pressure is the second force that has an action upon the teeth causing them to take their proper position. If everything is developing normally, from this time on the other four forces of occlusion act so near together that it is almost impossible to say which exerts an influence first or is the most important.

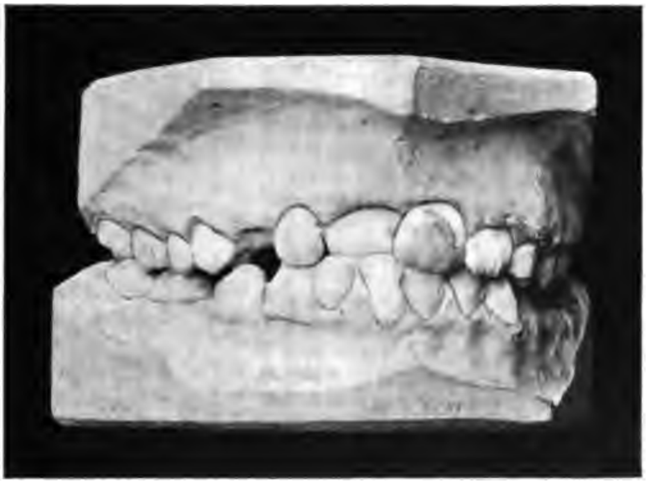

Fig. 8.
Malocclusion of central produced by abnormal locking of inclined planes.

Force of the Inclined Plane.—The author is inclined to believe that the third force or the force of the inclined plane is the next one to be an important factor as the teeth erupt. The force of muscular pressure has caused the upper and lower teeth to be placed in an arch which is about the shape of the tongue and which corresponds with the range of the activity of the muscles of the cheek and lip. As the upper and lower teeth approach each other we find that the inclined planes of the cusps of the occlusal surface come in contact, act in the nature of a wedge, and force the teeth to such a position that the cusps of the lower teeth will fall in the grooves and sulci of the upper teeth and the cusps of the upper teeth will fall in the fossæ and grooves of the lower teeth (Fig. 8). It has been shown that the mesio-lingual cusp of the upper molar occludes in the central fossa of the corresponding lower molar; also that the buccal cusps of the upper molars and premolars are buccal to the lower molars and premolars. Hardly ever do we find each cusp occupying its proper position when the cusps of the teeth first come in contact; but owing to the act of mastication, the cusps force themselves into the proper place, providing they have started in the right direction (Fig. 9). However, should one cusp be

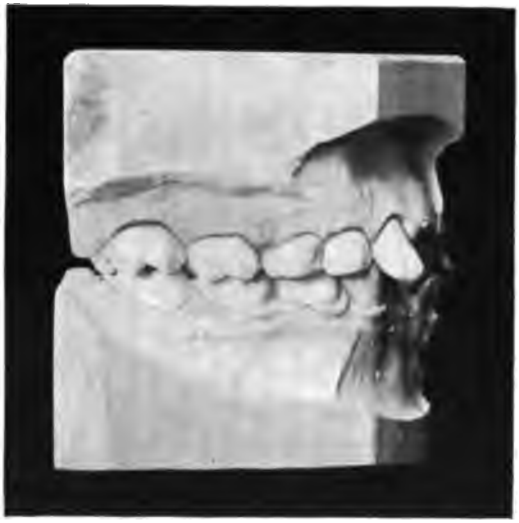

Fig. 9-A.

The position of first molars at this age easily permits of abnormal locking of cusps.

locked on the wrong incline it becomes a factor in producing malocclusion (Fig. 10) and instead of having a normal occlusion of the teeth we will have malocclusion. The force of the inclined plane is active, from the teeth in one arch to the teeth in the opposite arch.

Normal Approximal Contact.—The force of the approximal contact is the force which the approximating surfaces of the teeth of one arch exert on the approximating teeth of the same arch. It is different from the force of the inclined plane, as it acts only upon approximating teeth. For a number of years we failed to realize that there were certain cases in which the force of the inclined plane would be normal but the force of the approximal contact abnormal, resulting in troublesome types of malocclusion, the treatment of which can only be successfully accomplished by recognizing the relation of the approximal contact points (Fig. 11). After

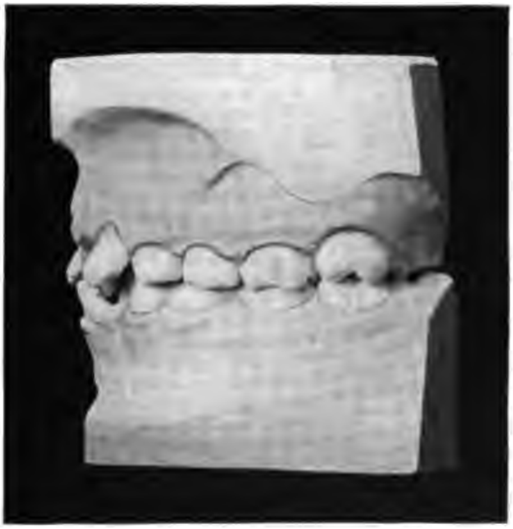

Fig. 9-B.

one tooth in either arch erupts, it has a guiding influence on the approximating tooth, helping to produce either normal occlusion or malocclusion. If two teeth

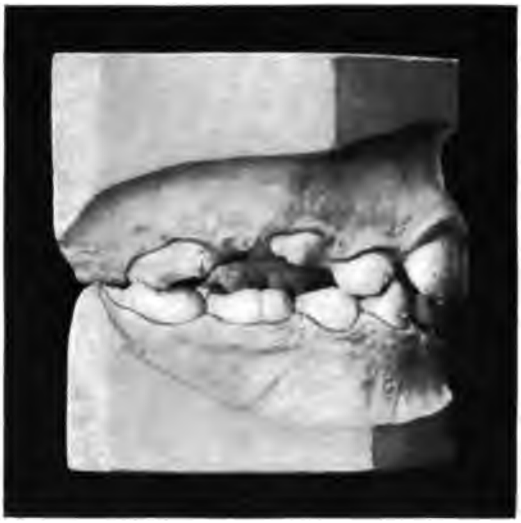

Fig. 10.
Abnormal locking of first molars will produce other malocclusions as age advances.

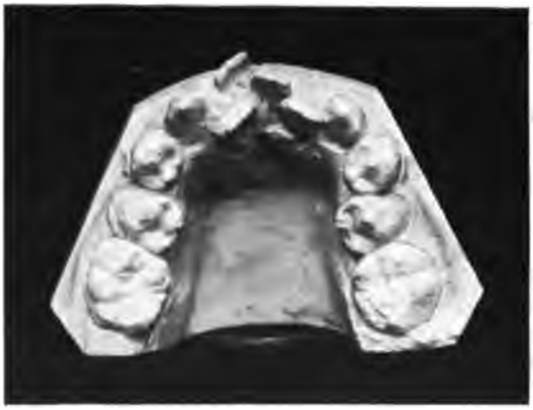

Fig. 11.
Showing abnormal approximal contacts of teeth and the influence of one tooth on the others.

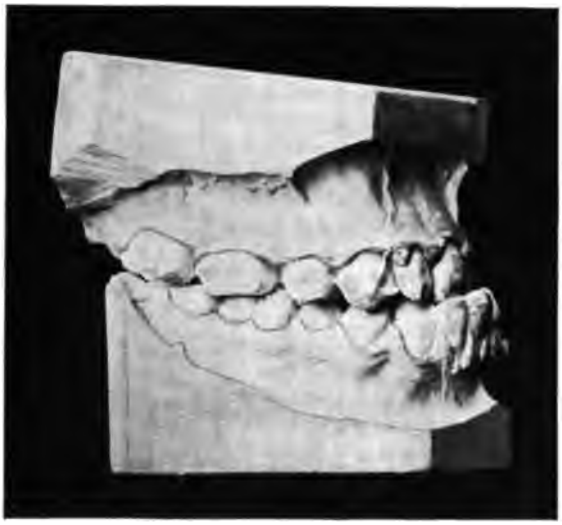

Fig. 12-A.

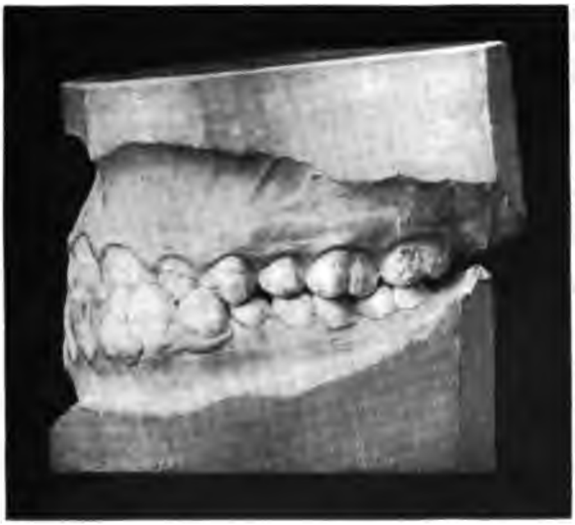

Fig. 12-B.

Showing abnormal locking of teeth and abnormal approximal contacts. The upper right second premolar (bicuspid) and upper left canine (cuspid) are crowded lingually because of abnormal approximal contact.

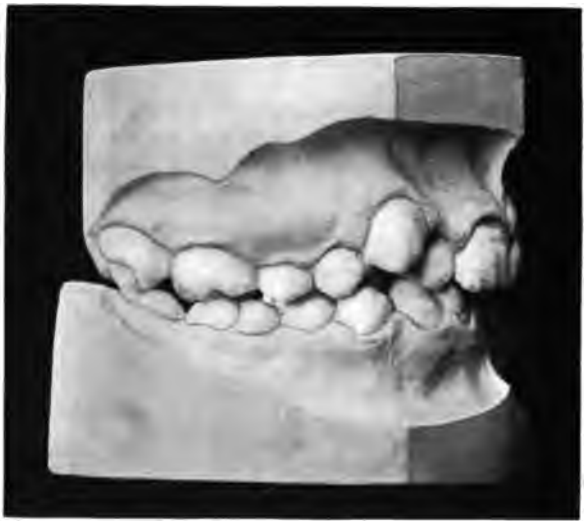

Fig. 13-A.

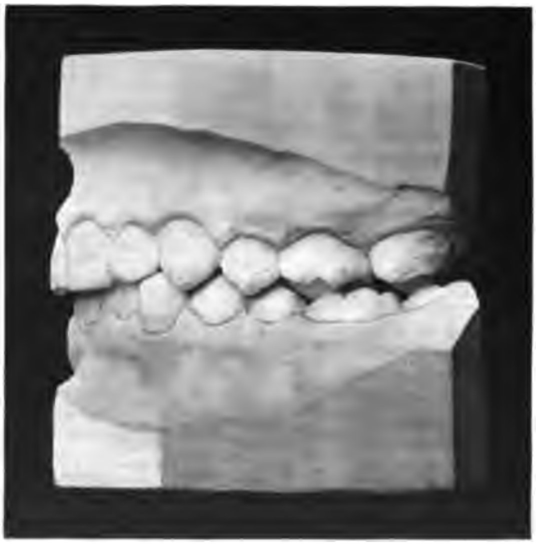

Fig. 13-B.

Shows malocclusion resulting from missing left upper second premolar (bicuspid), resulting in inharmony in size of arches.

have erupted and the space remains between them for the third tooth, the third tooth is influenced by the approximating tooth on its mesial and distal side (Fig. 12). The force of the approximal contact is probably more important in the eruption of the permanent teeth than it is in the eruption of the deciduous teeth. It therefore becomes necessary that the normal approximal contact of the deciduous teeth must be maintained in order that the permanent teeth will erupt in their proper position in the dental arch. A great many cases of malocclusion are produced in the permanent teeth because this condition has been overlooked.

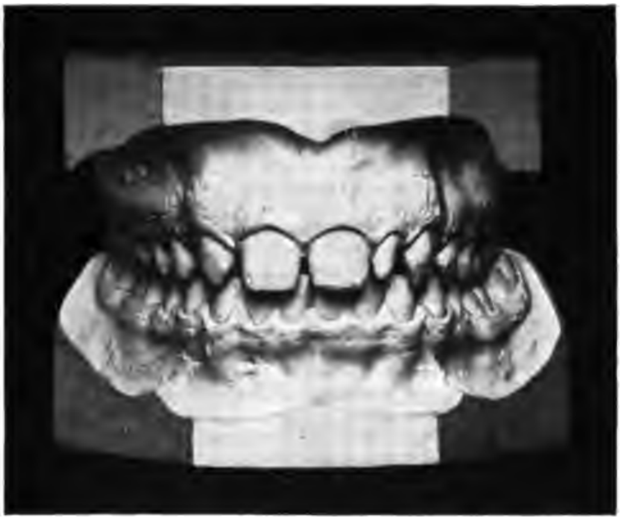

Fig. 13-C.
Malocclusion produced by missing lateral.

Harmony in the Size of the Arches.—By "Harmony in the size of the arches" is meant that the teeth in the upper arch and the teeth in the lower arch are so arranged that when in normal occlusion, each one occupying the proper position in the line of occlusion, the line of greatest occlusal contact will be the same in both arches. If there is one more tooth in the lower than in the upper arch (Fig. 13), it necessarily will produce inharmony in the size of the arches, resulting in malocclusion. Likewise, if there is a missing tooth in the lower arch, malocclusion of the upper arch will result (Fig. 14). Malocclusion may be produced by inharmony in the size of the arches when the inharmony has been the result of the decay of the teeth, causing destruction of the approximal contact. So it will be seen that very often in the loss of one of the forces of occlusion a second one is also disturbed, finally causing an inharmonious action of all of them.

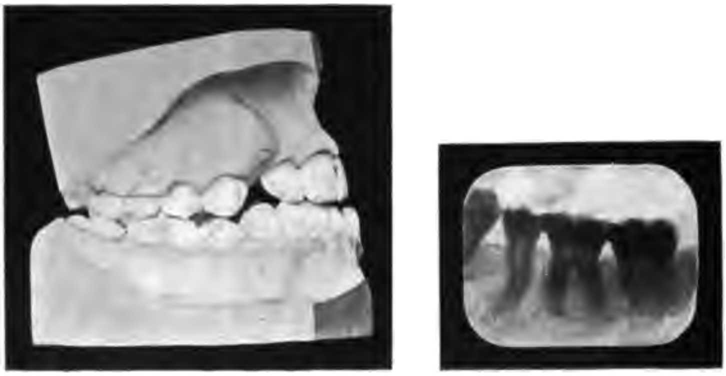

Fig. 14-A. Fig. 14-B.
Showing missing lower second premolar (bicuspid).

Normal Atmospheric Pressure.—Normal atmospheric pressure is that pressure produced in the nasal and oral cavities during normal respiration and deglutition. If the individual breathes through the nose, with each inspiration and expiration a pressure is exerted on all sides of the nasal cavity. Not only is a pressure exerted in the nasal cavity, but it is also produced in all of the nasal sinuses (Figs. 15 and 77). As a result of atmospheric pressure the nasal cavity is developed to its proper size, consequently this pressure plays an important part in the development of the dental arch. In normal breathing, the proper action of the muscles of the lips, cheeks and tongue are present, which results

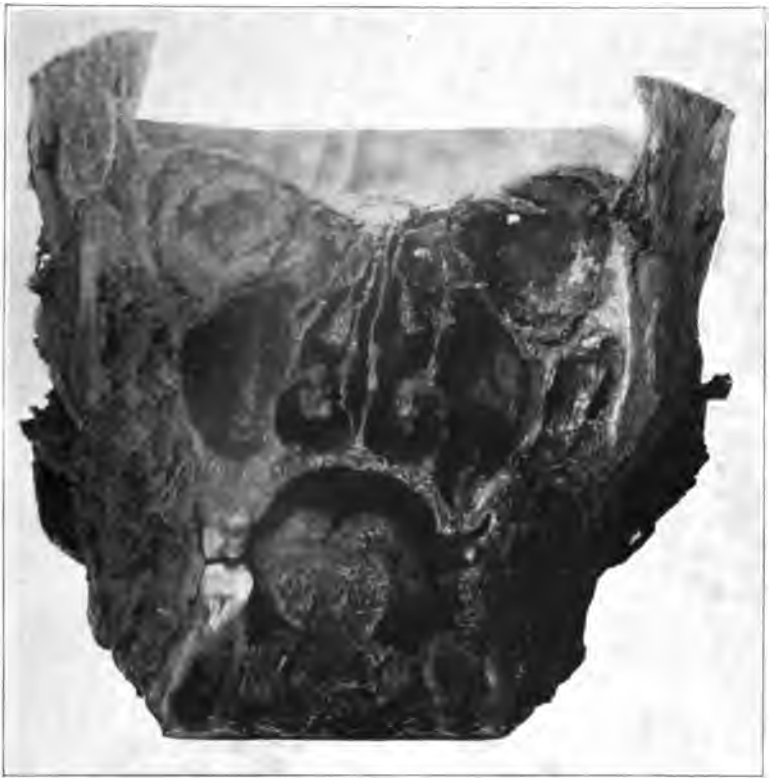

Fig. 15.
Posterior portion of nasal cavity and sinuses. Note position of lingual cusp of upper molar.

in the proper muscular pressure; therefore, with the loss of normal breathing, muscular pressure is disturbed causing two forces of occlusion to be perverted. Such resulting malocclusions as we find in Class II, Division

1, (Fig. 16) are primarily the result of disturbed atmospheric pressure and abnormal pressure of the cheeks,

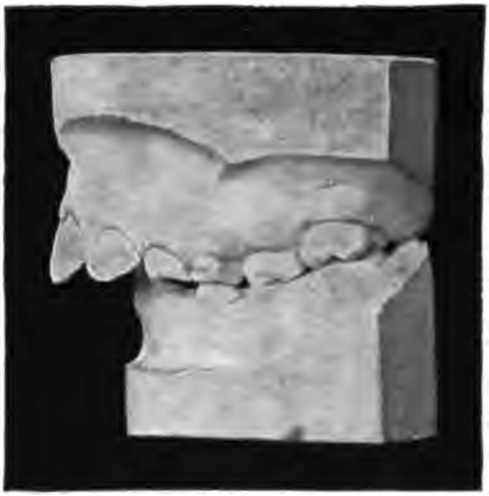

Fig. 16.
Typical case of malocclusion caused by mouth-breathing.

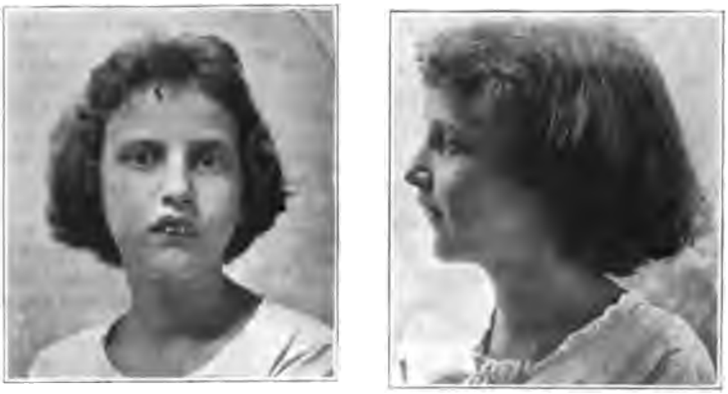

Fig. 17-A. Fig. 17-B.
Facial deformity associated with mouth-breathing.

lips, and tongue (Fig. 17). Another very important phase of atmospheric pressure and muscular action takes place after we cease speaking—we close the lips and swallow, a vacuum being created in the oral cavity which in turn forces the tongue up against the roof of the mouth and exerts pressure upon the upper and lower teeth. In mouth-breathing the tongue exerts a pressure only on the lower arch and mostly upon the lower molars and premolars. Atmospheric pressure is an active force during all the time that the individual is breathing. If at any time breathing becomes abnormal and the atmospheric pressure is disturbed, malocclusion will result. Should children become mouth-breathers early, malocclusion will develop shortly after the mouth-breathing occurs. Any of these forces of occlusion acting in the wrong direction then become forces of malocclusion. Acquired cases of malocclusion are simply the result of some condition that has resulted from one or more of the forces of occlusion having been disturbed. Therefore, it becomes imperative that any effort toward the correction of malocclusion must be of such a nature that it will not only place the teeth in their proper position in the line of occlusion but if they are expected to stay there all six of the forces of occlusion must be normal and remain normal.

CHAPTER III.

MALOCCLUSION.

Malocclusion is the deviation from normal occlusion to such an extent as to interfere with the proper functions of the teeth.

Positions of Malocclusion.

"Positions of Malocclusion" deals with the individual teeth or the relation of the teeth of one arch to the approximating teeth of the same arch. The positions of malocclusion may be defined as the relation of the individual teeth to the line of occlusion and the median line of the face.

In order to be perfectly clear on this subject, we might again state that the line of occlusion is that line with which, in form and position according to type, the teeth must be in harmony if in normal occlusion (Angle).

There are seven distinct positions of malocclusion, named from the position which the teeth occupy to the line of occlusion and the median line of the face. The line of occlusion is divided into the right and left half (Fig. 18) by the median line of the face.

A tooth which is too near the median line of the face or too far towards the middle of the arch, is said to be in *mesial occlusion.*

One which is too far in the opposite direction or towards the posterior portion of the arch is in *distal occlusion.*

A tooth which is too far towards the lips or cheeks is in *labial* or *buccal occlusion.* Labial occlusion is applied to the six anterior teeth and buccal occlusion to the posterior teeth.

A tooth which is too far to the lingual side of the line of occlusion is said to be in *lingual occlusion.*

One which is too short, that is, has not erupted far enough to reach the plane of occlusion, is in *infra-occlusion.*

One which has grown too long is in *supra-occlusion.*

A tooth which does not occupy a proper axis in the line of occlusion is said to be in *torsi-occlusion,* it being rotated on its axis.

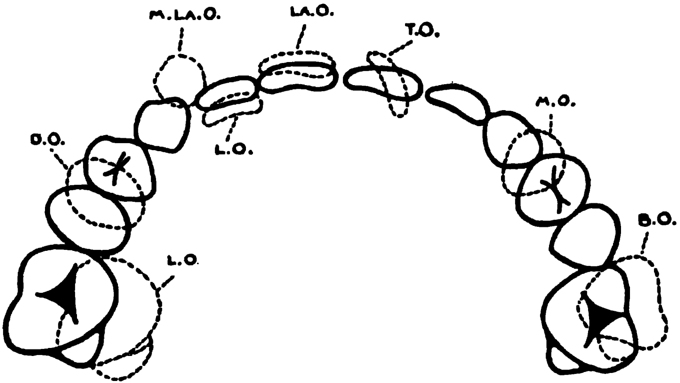

Fig. 18.

Positions of malocclusion. Heavy black lines indicate normal position. Dotted lines indicate positions of malocclusion.

La. O.—Labial occlusion.
L. O.—Lingual occlusion.
T. O.—Torsi-occlusion.
D. O.—Distal occlusion.
M. O.—Mesial occlusion.
B. O.—Buccal occlusion.
M. La. O.—Mesio-labial occlusion.

We also have various combinations of these positions, for a tooth may be too far mesial and also rotated; it would then be in *torsi-mesial occlusion.* Likewise, it may be in any of the other four positions. A tooth may be in mesial occlusion, not erupted far enough and also rotated, in which case it would be in *mesio-torsi-infra-occlusion.* Various combinations will result from various positions of the teeth. A tooth may be too far mesial, may be rotated, be in infra-occlusion, and also occupy a labial position, in which case it is spoken of as being in *mesio-labial-torsi-infra-occlusion.*

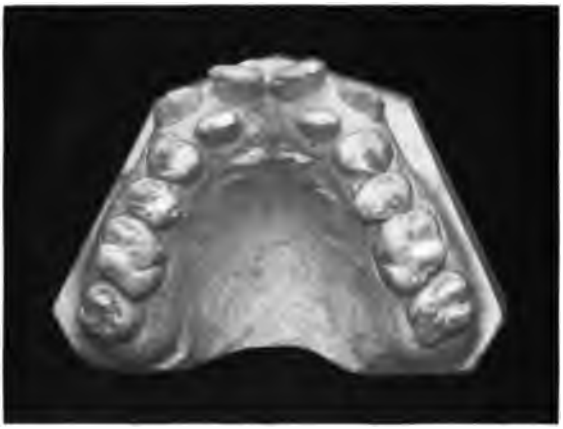

Fig. 19-A.

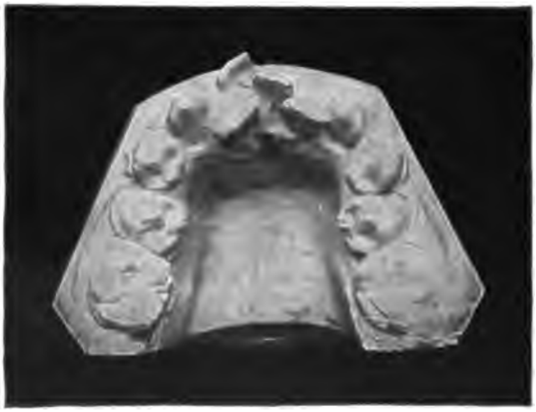

Fig. 19-B.
Upper and lower molars and premolars are in lingual occlusion. Lateral incisors are in linguo-torsi-occlusion.

With the seven primary positions of malocclusion it is possible for a tooth to occupy four of them at one time. To move a tooth into the proper position, it would necessarily have to be moved in four different directions. So positions of malocclusion while comparatively simple offer various complications in treatment (Fig. 19).

Classification of Malocclusion.

Classes of malocclusion deal with the relation of the lower teeth to the upper. Of course, the positions of malocclusion have some relation in the formation of the class, the principal one being the mesial and distal[1] relation of the arches. We have shown in the study of normal occlusion that the mesio-buccal cusp of the upper first molar occludes in the buccal groove of the lower first molar. Also the mesio-lingual cusp of the upper first molar falls into the central fossa of the lower first molar. The upper canine occludes between the lower canine and the lower first premolar. The relation of the mesio-buccal cusp of the upper first molar to the buccal groove has been called by Angle the "Key to Occlusion." Other cusps are just as important, but we must select some definite points and keep them in mind in deciding whether the teeth occupy a proper mesio-distal relation to the opposing teeth. We must take into consideration more than one tooth in order to decide whether the dental arches occupy their proper mesio-distal[2] relation to each other, for classification of malocclusion depends upon whether the arches occupy a normal mesio-distal relation or are too far forward or too far back.

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[1] The author considers *mesial* and *distal* more appropriate terms than *anterior* and *posterior,* and therefore has used the former throughout this volume.

[2] The author prefers the term *mesio-distal* to *antero-posterior.*

The lower teeth being the movable arch, we speak of them as being in normal mesio-distal (antero-posterior) relation to the upper arch, or as the lower teeth being in distal (posterior) relation to the upper arch, or the lower teeth in mesial (anterior) relation to the upper arch. Following this plan, malocclusion of the arches can therefore be divided into three general classes. They can be distinguished either by number or by some term descriptive of the condition. However, at the present time it has been impossible to find a term which describes all of the characteristics present in the various types of these three classes of malocclusion. By three classes we mean that in all cases of malocclusion the lower arch must either be normal mesio-distally, or the lower arch distal (posterior) or mesial (anterior) to the upper. Therefore, one group of cases would include those in which there was a distal (posterior) relation of the lower arch to the upper and another group would include those in which the lower teeth were mesial (anterior) to the upper. Cases which possess these characteristics are said to belong to a certain class of malocclusion. There are cases in which one side is in normal mesio-distal (antero-posterior) relation and the other side of the lower arch either in distal (posterior) or mesial (anterior) relation to the upper, which would necessarily have to be distinguished in some other manner and are spoken of as being a subdivision of some class. We have shown that malocclusions are based upon the mesial (anterior) and distal (posterior) relation of the dental arches and that a case of malocclusion must either be normal mesio-distally or the lower teeth distal or mesial to the upper. Therefore, it would be very easy to designate these classes of malocclusion as Class I, II, and III, as was done by Angle. The objection has been raised that this

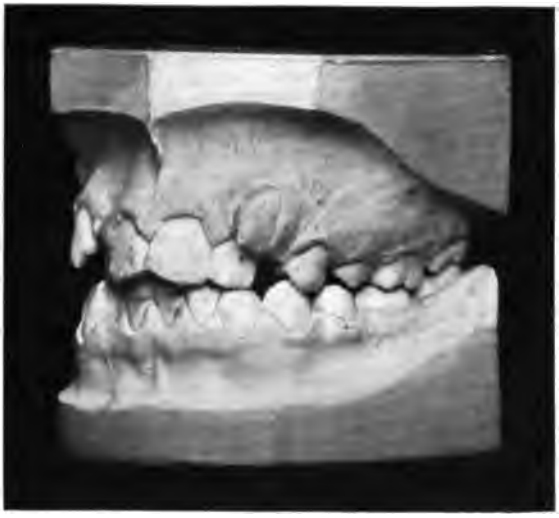

Fig. 20-A.
Class I (Angle) showing normal mesio-distal (antero-posterior) relation of arches.

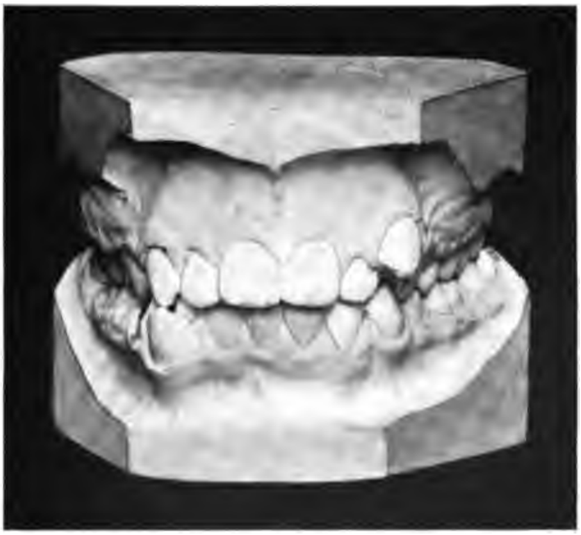

Fig. 20-B.
Another type of Class I, or normal mesio-distal (antero-posterior) relation of arches.

basis of classification has no scientific value to one who is not familiar with orthodontia or rather with Angle's plan of classification. However, until something decidedly better is suggested, the author believes it best to follow the plan suggested by Angle. Lischer has suggested that Class I cases be called "neutroclusion," Class II cases "distoclusion," and Class III cases "mesioclusion," which terms are no more explanatory to the layman than Class I, II, and III.

Class I.

Cases belonging to Class I are those which present a normal mesio-distal relation of the arches (Fig. 20). The anterior teeth may occupy any of the seven positions of malocclusion, although the majority of Class I cases show bunching of the anterior teeth. Some of the teeth are in torsi-lingual occlusion, while others may be in labial occlusion. There is generally a narrowing of the upper and lower arches which would mean that the molars and premolars are in lingual occlusion. The one outstanding feature which is normal, regarding the teeth in this class, is that we must have a normal mesio-distal relation of the arches as indicated by the occlusal relation of the upper and lower first molars. If all of the teeth are present, that will be equivalent to saying that we have a normal mesio-distal relation of the molars. One or both sides of the molars may be in lingual occlusion (Fig. 21). It must also be remembered that a normal mesio-distal relation of the arches does not necessarily imply a normal mesio-distal relation of the molars. Owing to the early loss of the deciduous molar, as shown in Fig. 22, the first permanent molar on the right side has drifted mesially, while all of the other teeth have a nor-

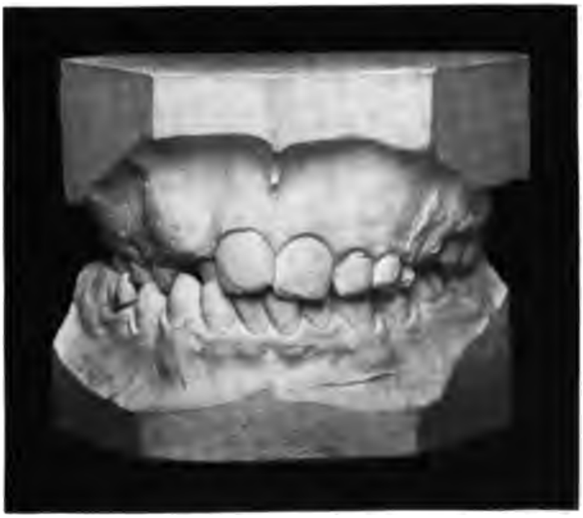

Fig. 21-A.

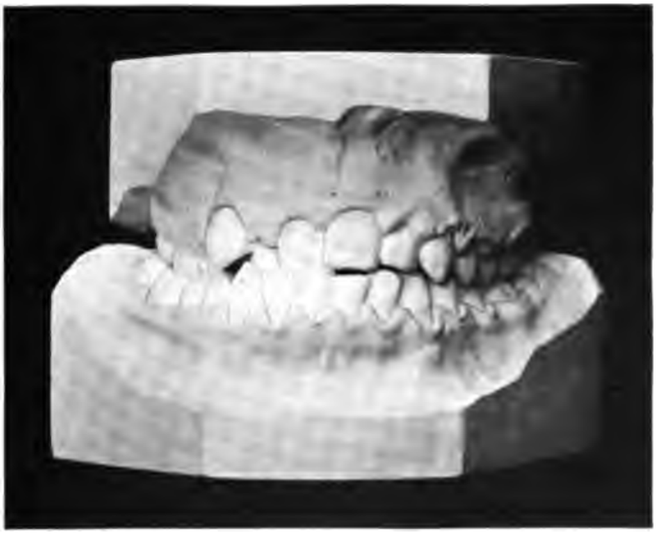

Fig. 21-B.
Normal mesio-distal relation of arches with lingual occlusion of right upper molars and premolars (bicuspids) to lowers. Class I case.

mal mesio-distal relation to each other, which shows a normal mesio-distal relation of the arches. Fig. 23 shows a case of an older patient, also caused by the drifting of the upper molar forward as a result of the loss of the deciduous molar. Fig. 24 shows the occlusal view of the case. Again there is a normal relation of the arches, but not of the molars. Therefore, both of these cases (Figs. 22 and 23) are Class I cases.

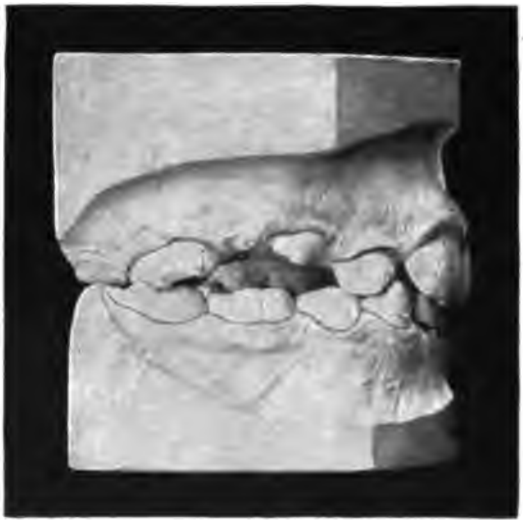

Fig. 22.

Abnormal mesio-distal relation of first permanent molars with normal mesio-distal (antero-posterior) relation of arches. Class I case.

Class I, Mutilated Cases.—If any of the teeth have been extracted or are missing, we will often find in these cases a normal mesio-distal relation of arches, and not necessarily a normal mesio-distal relation of the molars and remaining teeth (Fig. 22). In classifying cases where there is a normal mesio-distal relation of the arches and some of the teeth have been lost by extraction, we have to resolve the condition to what it would have been before the loss of the tooth, whether it is a premature loss of a deciduous tooth or the loss of a permanent tooth. Such cases as have been described above are spoken of and classified as Class I, mutilated (Fig. 25).

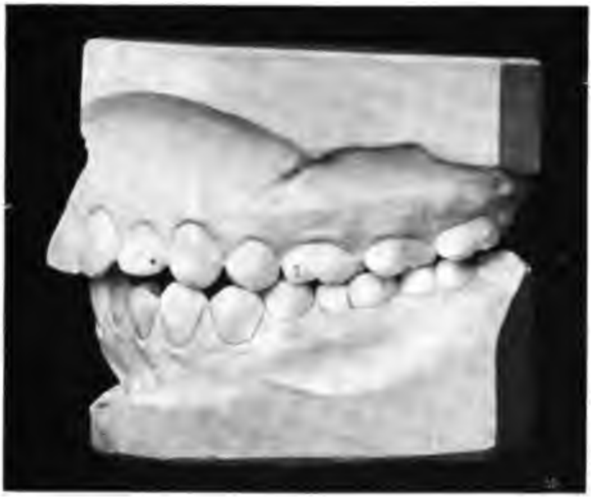

Fig. 23.

Upper left second premolar impacted by the drifting of molars mesially, due to early loss of deciduous molar. Arch relations normal mesio-distally (antero-posterior). Class I case.

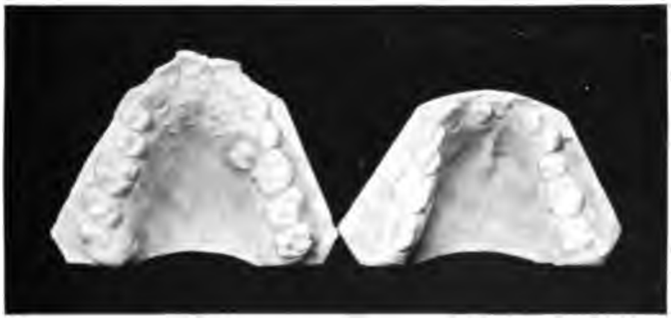

Fig. 24.

Showing position of impacted premolar (bicuspid).

Types of Class I.—Class I presents several different types which demand special mention because they pre-

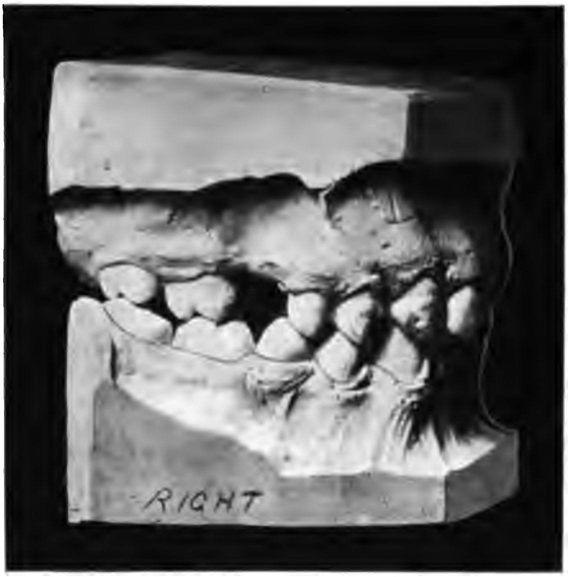

Fig. 25.
Mutilated case of Class I.

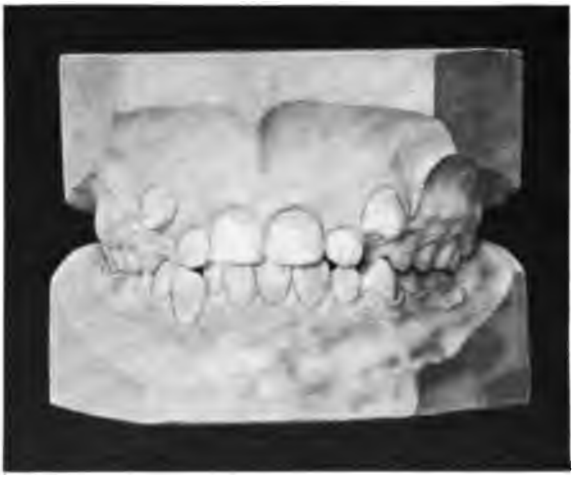

Fig. 26.
Class I, Type 1 case.

sent characteristics which demand special treatment. They are Types 1, 2, and 3 of Class I.

Class I, Type 1.—These cases are characterized by a normal mesio-distal relation of the arches (Fig. 20). All of the teeth are in lingual occlusion, except in certain cases we find some or all of the canines in labial occlusion (Fig. 26). The upper and lower molars and premolars are in lingual occlusion and demand expansion. The upper molars and premolars may be in lingual occlusion to the lower molars and premolars on one or both sides.

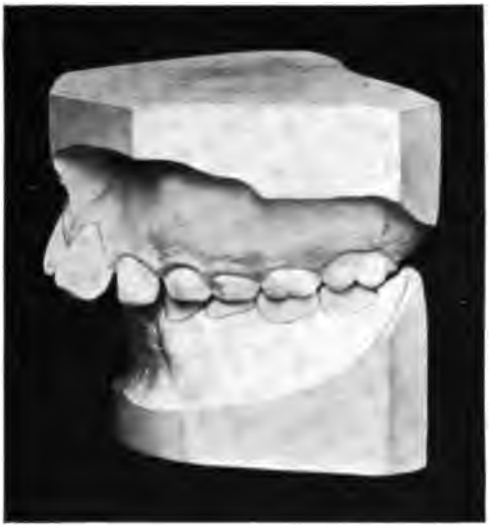

Fig. 27.
Class I, Type 2 case. Normal mesio-distal relation of arches. Protrusion (labial occlusion) of superior incisors.

There is a condition of the teeth which could be described as "bunched."

Class I, Type 2.—Cases belonging to this type are characterized by a normal mesio-distal relation of the arches, protruding upper anterior teeth (Fig. 27), bunched lower anterior teeth and narrow upper and lower arches. The upper and lower molars and pre-

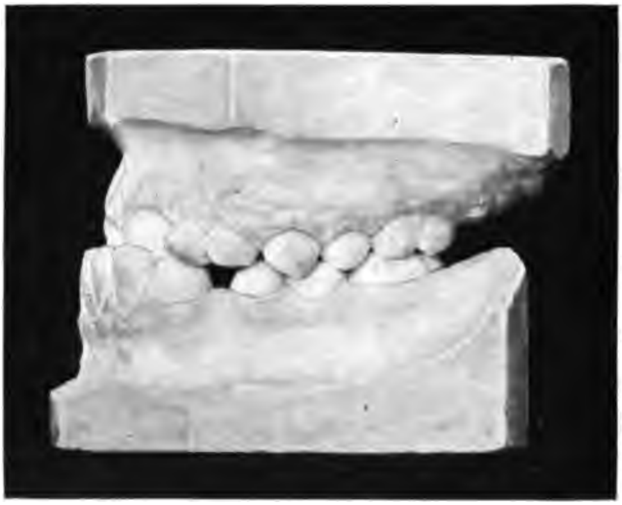

Fig. 28.

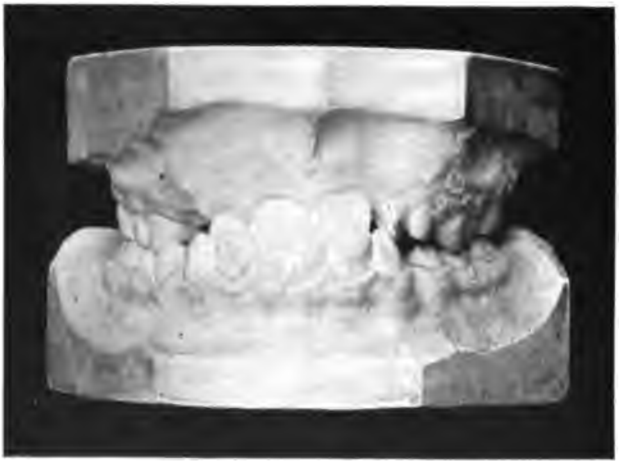

Fig. 29.

Class I. Type 3 case. Normal mesio-distal relation of arches with lingual occlusion of upper incisors to lowers. Also slight mesial occlusion of lower incisors caused by abnormal force of the inclined planes of anterior teeth.

molars generally occupy the proper bucco-lingual relation to each other. The patient is or has been at some time a mouth-breather, or has a lip-habit.

Class I, Type 3.—Here we find a normal mesio-distal relation of the arches (Fig. 28). Upper incisors are in lingual occlusion to the lowers (Fig. 29), with bunching of the upper anterior teeth and lack of development in the premaxillæ region. The teeth of the lower arch may be bunched or occupy a nearly normal approximal relation to each other (Fig. 30). The lower lip appears prominent because the upper lip is underdeveloped as a result of the position of the upper teeth.

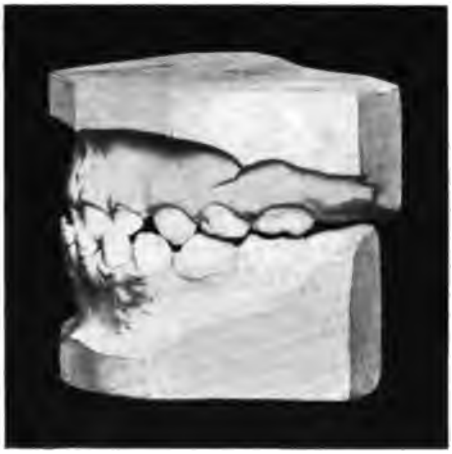

Fig. 30.
Class I. Type 3 case.

Either of these types of Class I may be complicated by mutilations.

Class II.

Class II cases of malocclusion are those which are characterized by a distal (posterior) relation of the lower arch. Class II cases are divided into Divisions 1 and 2.

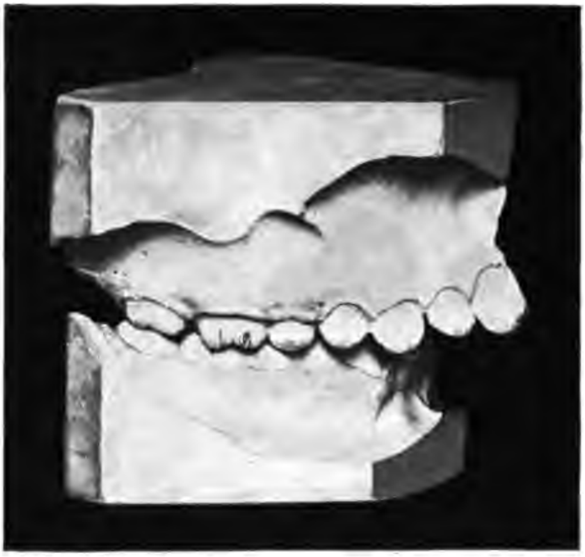

Fig. 31.

Class II, Division 1 case. Bilaterally distal (posterior) relation of lower arch. Narrow upper arch. Protruding superior anterior teeth.

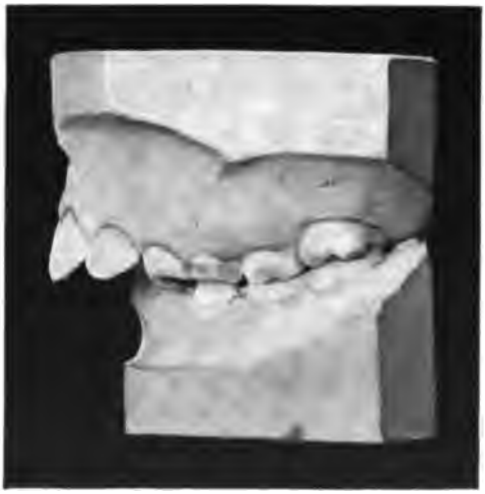

Fig. 32.

Class II, Division 1 case. Bilaterally distal relation of lower arch.

Class II, Division 1.—Division 1 cases are those which are characterized by a distal relation of the lower arch to the upper the width of a premolar (Figs. 31 and 32). Instead of the mesio-buccal cusp of the upper first molar occupying a mesio-distal relation corresponding to the buccal groove of the lower first molar, we find it occupying a mesio-distal relation corresponding to the buccal embrasure between the lower first molar and lower second premolar. The other characteristics of Class II, Division 1, are as follows: A narrow upper arch, protruding anterior teeth, a mandible which is deficient, an underdeveloped or receded chin, abnormal muscular pressure, a short upper lip and mouth-breathing (Fig. 33). Mouth-breathing has disturbed the other forces of occlusion, especially muscular pressure, which has resulted in allowing the upper anterior teeth to protrude in the upper arch and permitted them to remain in an undeveloped condition bucco-lingually. The underdeveloped

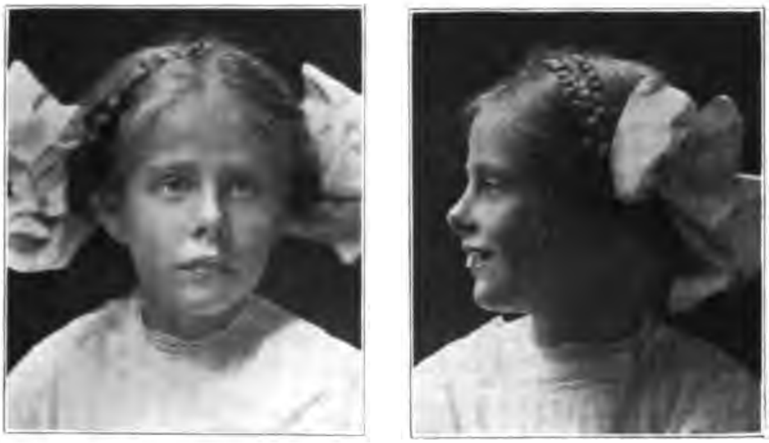

Fig. 33-A. Fig. 33-B.

Class II, Division 1 case. Malocclusion shown in Fig. 32. Short upper lip, abnormal muscular pressure, mouth-breathing.

mandible and the receding chin are the result of the distal occlusion of the lower teeth and the abnormal action of the muscles.

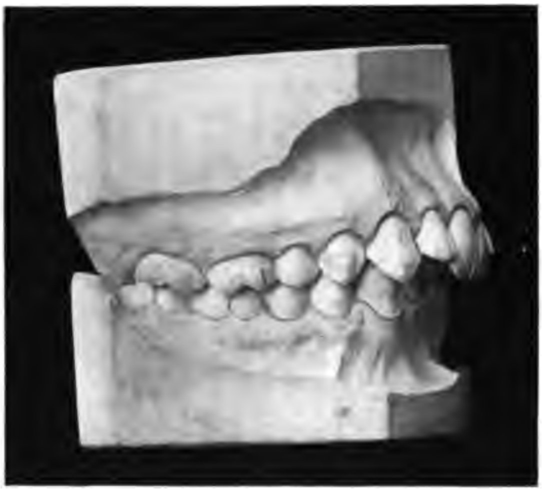

Fig. 34-A.

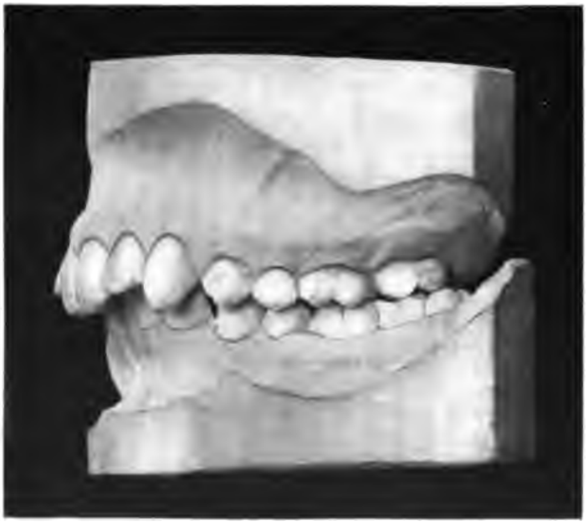

Fig. 34-B.

Class II, Division 2 case. Bilaterally distal (posterior) relation of lower arch. Retruding or bunched upper incisors.

Class II, Division 2.—Class II, Division 2 (Fig. 34) is characterized by the distal relation of the lower arch to the same extent as in Division 1. The other characteristics are directly opposite. We have an upper arch which is nearly normal in width with retruding and bunched anterior teeth. The mandible is more nearly normally developed and the chin is not receding. We have normal pressure of the lips and cheeks and normal action of the tongue and normal breathing. The difference between Division 1, Class II, and Division 2, Class II, is the difference between normal and abnormal muscular pressure. In order to more clearly numerate the differences between Division 1 and Division 2, they are given in tabulated form opposite each other in the following table:

Class II.

DIVISION 1.	DIVISION 2.
Bilaterally distal relation of the lower arch.	Bilaterally distal relation of the lower arch.
Protruding anterior upper teeth.	Retruding and bunched upper anterior teeth.
Narrow upper arch.	Upper arch nearly normal in width.
Undersized chin.	Normal-sized chin.
Undersized mandible.	Normal-sized mandible.
Abnormal muscular pressure.	Normal muscular pressure.
Abnormal atmospheric pressure.	Normal atmospheric pressure.
Mouth-breathing.	Normal breathing.
Subdivision of Class II, Division 1.	Subdivision of Class II, Division 2.
Unilaterally distal with the same characteristics as Division 1.	Unilaterally distal with the same characteristics as Division 2.
One side of the lower arch is in normal mesio-distal relation to the upper.	One side of the arch is in normal mesio-distal relation to the upper.

Both Division 1 and Division 2 of Class II sometimes show a distal relation of the lower arch present only on one side. It may be on either the right or left side according as the etiological factors have been present.

These cases of Division 1 and Division 2 are therefore called subdivisions and are named as Class II, Division

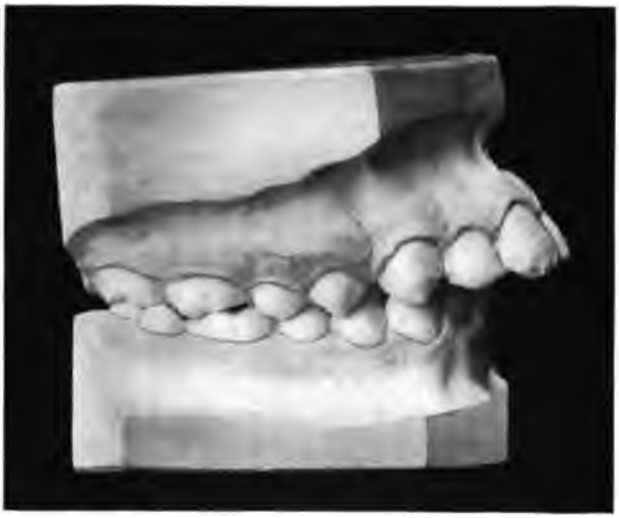

Fig. 35-A.

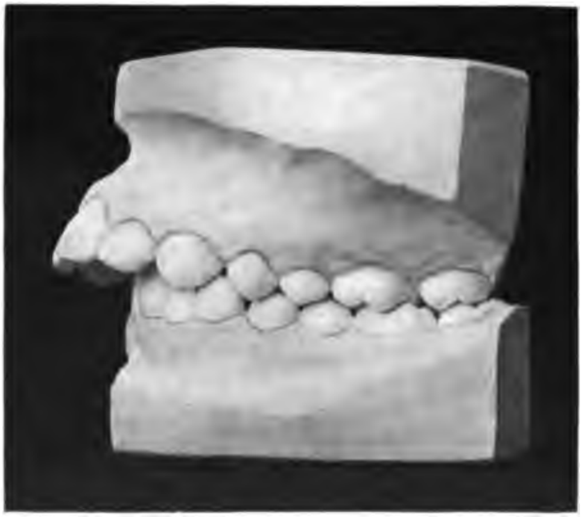

Fig. 35-B.

Class II, Division 1, Subdivision. Unilaterally distal (posterior) relation of lower arch (left side of lower, distal; right side, normal. Protruding superior anterior teeth.

1, Subdivision; or Class II, Division 2, Subdivision; or just reversing them and saying Subdivision of Division 1 of Class II, or Subdivision of Division 2 of Class II. These subdivisions are spoken of as being unilaterally distal. The other characteristics are exactly the same as found in Division 1 and Division 2 (as shown in table). For example, a subdivision of Division 1, Class II (Fig. 35) would be a case in which we had a normal mesio-distal relation of the arches on one side, with a distal relation of the lower arch on the other, a narrow upper arch, protruding anterior teeth, underdeveloped mandible, a receding chin, abnormal muscular pressure and abnormal breathing. A subdivision of Division 2 of Class II (Fig. 36) would be a case in which the lower arch was distal on one side; on the other side normal mesio-distally. An upper arch nearly normal in width, retruding and bunched upper incisor, a mandible of nearly normal size, a normal chin, normal muscular pressure, normal atmospheric pressure and normal breathing. It does not matter, so far as the classification is concerned, whether the right or left side in these subdivision cases is normal or abnormal mesio-distally.

Class III.

Class III cases are those that are characterized by the mesial relation of the lower arch to the upper arch the width of one premolar (Fig. 37). The mesio-buccal cusp of the upper first molar occupies a mesio-distal relation which corresponds to the buccal embrasure between the lower first and second molars.

Class III presents a division and subdivision, and also three types.

Class III, Type 1.—These cases present a mesial relation of the lower arch to the upper (Fig. 38). The teeth

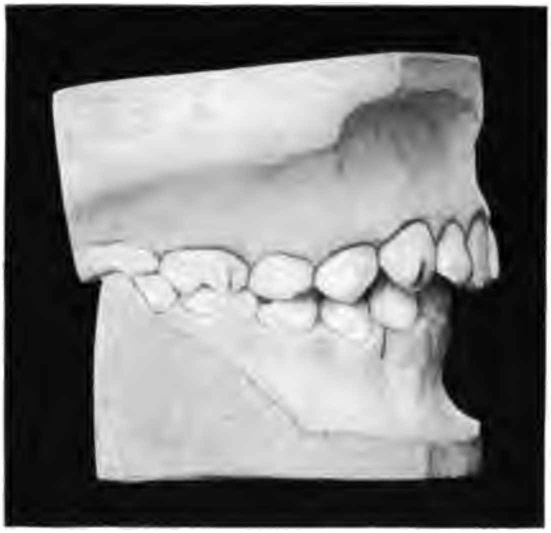

Fig. 36-A.

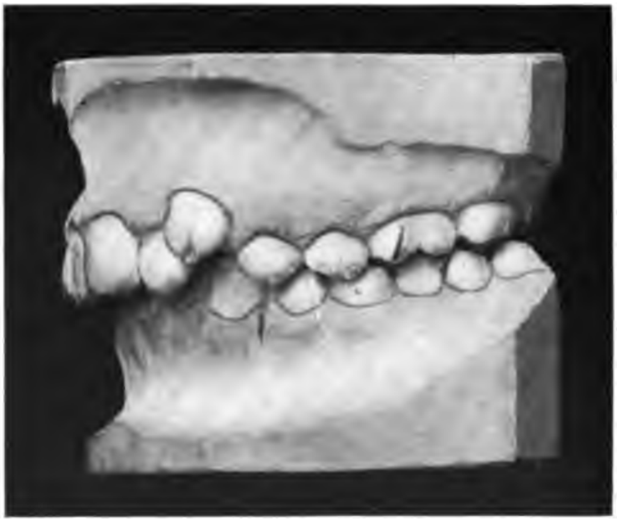

Fig. 36-B.

Class II, Division 2, Subdivision. Unilaterally distal relation of lower arch. Right side, normal; left side, distal. Bunched superior anterior teeth.

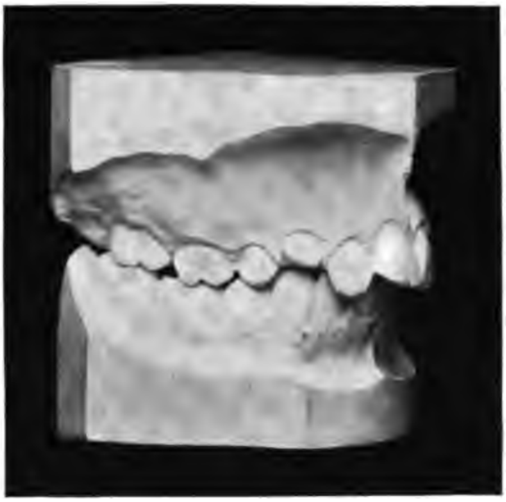

Fig. 36-C.

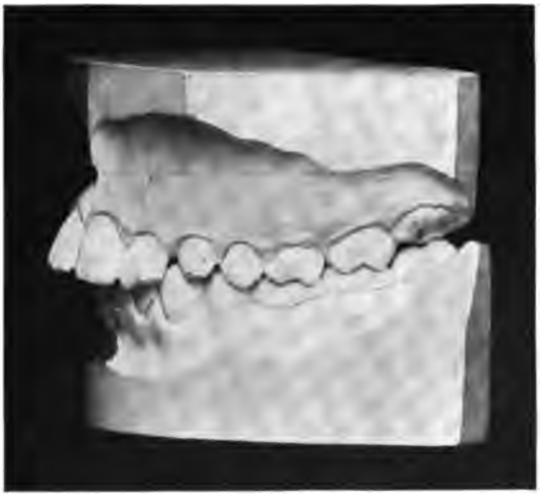

Fig. 36-D.

Class II, Division 2, Subdivision. Unilaterally distal relation of lower arch. Left side normal; right side, distal. Normal lip pressure is bunching anterior teeth.

in each arch present an even alignment, practically no torsi-occlusion in either arch. Each dental arch is very nearly the correct shape and if viewed separately from the occlusal view, the true condition of the malocclusion would not suggest itself. There is an appearance of the lower arch having moved forward from a normal occlusion to one that is mesial. The lip pressure is normal and we have normal breathing.

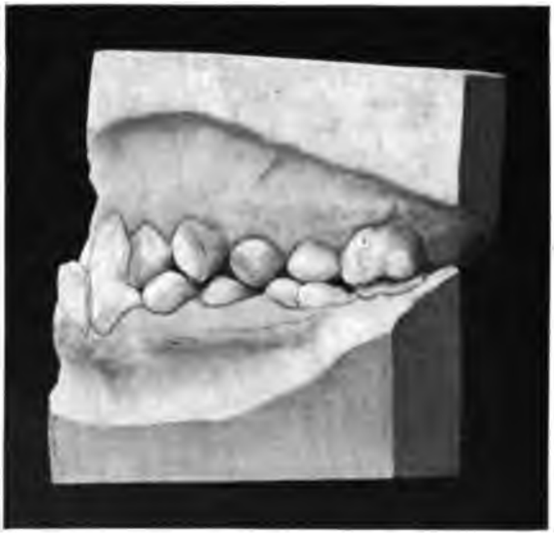

Fig. 37.
Class III. Mesial (anterior) relation of lower arch.

Class III, Type 2.—The lower arch is mesial to the upper the width of one premolar. The upper teeth are in good alignment with little torsi-occlusion (Fig. 39). The lower incisors are bunched and in lingual relation to the uppers. The patient is a normal breather with normal lip habits. This type presents less facial deformity than any of the other types of Class III, because the lower anterior teeth are bunched and there is little overdevelopment of the mandible.

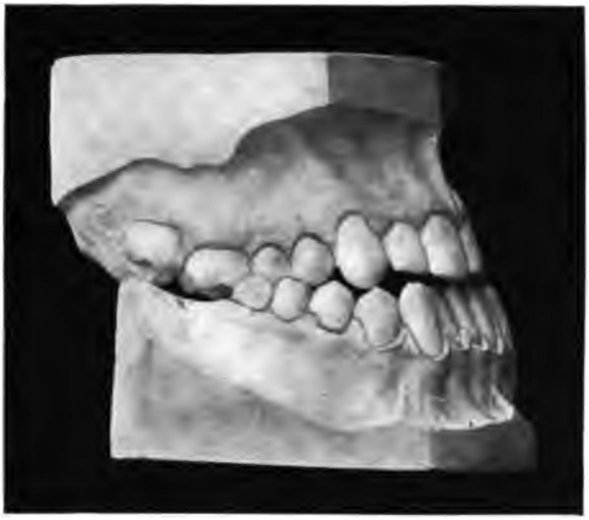

Fig. 38-A.

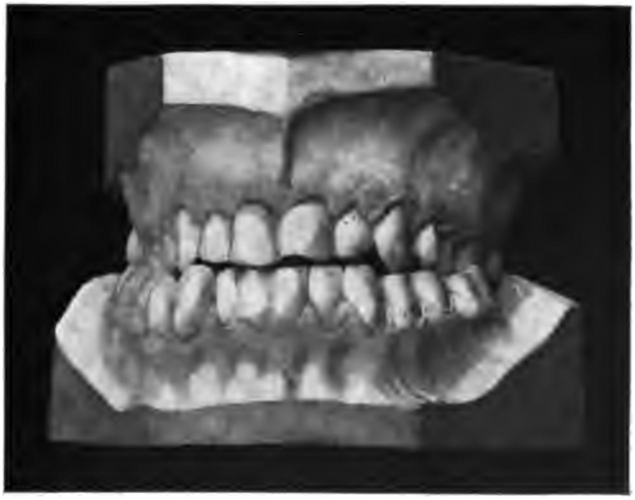

Fig. 38-B.

Class III, Type 1. Bilaterally mesial (anterior) relation of lower arch with fairly even alignment of the upper and lower teeth.

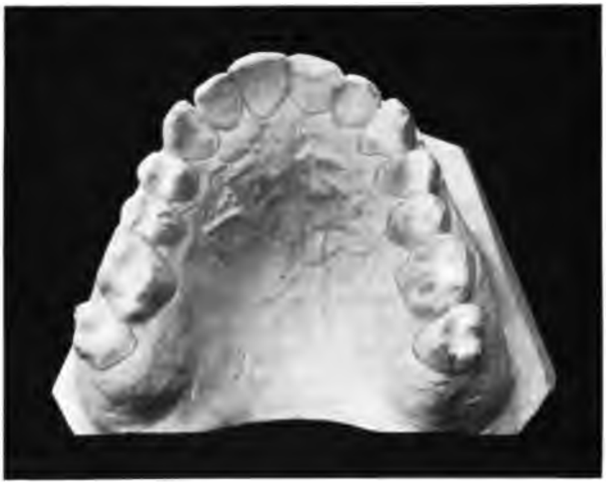

Fig. 38-C.

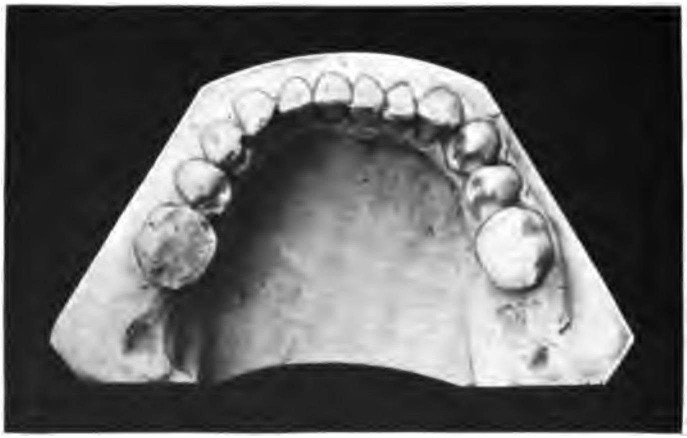

Fig. 38-D.

Class III, Type 1. Showing even alignment of teeth in each arch.

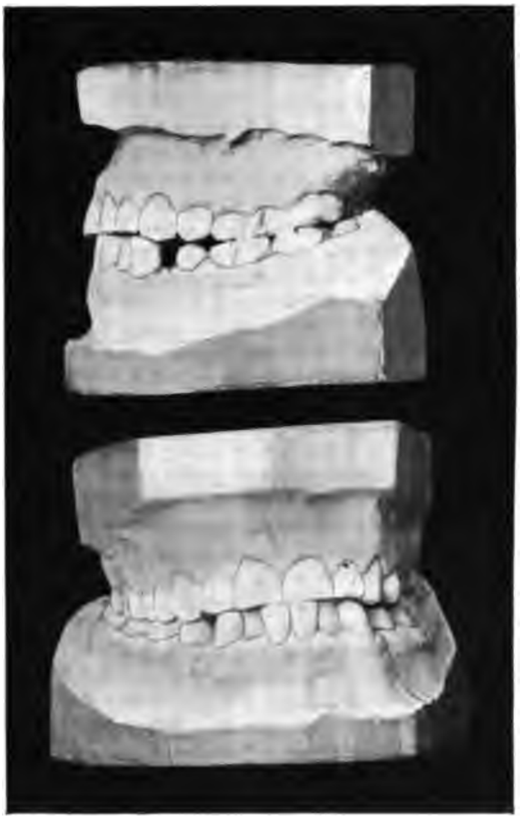

Fig. 39-A.

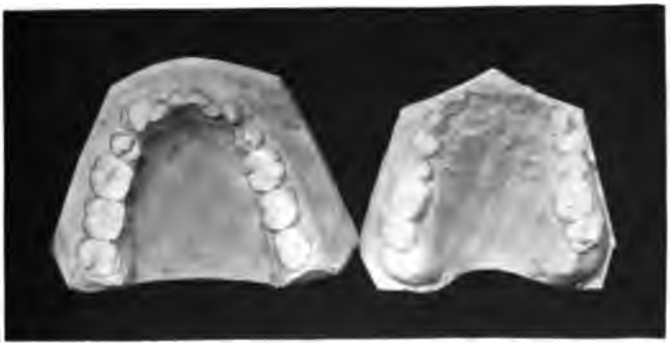

Fig. 39-B.

Class III, Type 2. Bilaterally mesial relation of lower arch. Bunched lower anterior teeth.

Class III, Type 3.—The lower arch is mesial to the upper the width of one premolar (Fig. 40). The upper arch is underdeveloped and the anterior teeth bunched and in lingual occlusion to the lowers. The lower teeth are in fairly good alignment.

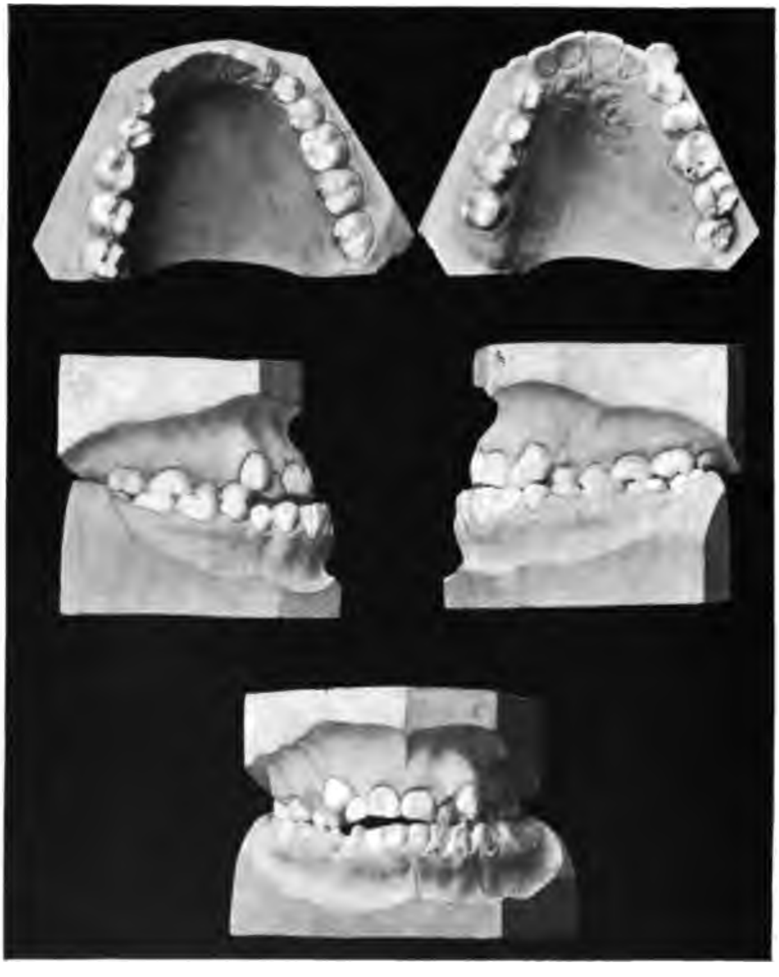

Fig. 40.
Class III, Type 3. Bilaterally mesial relation of lower arch. Bunched upper anterior teeth. Small upper arch. Lower teeth in fair alignment.

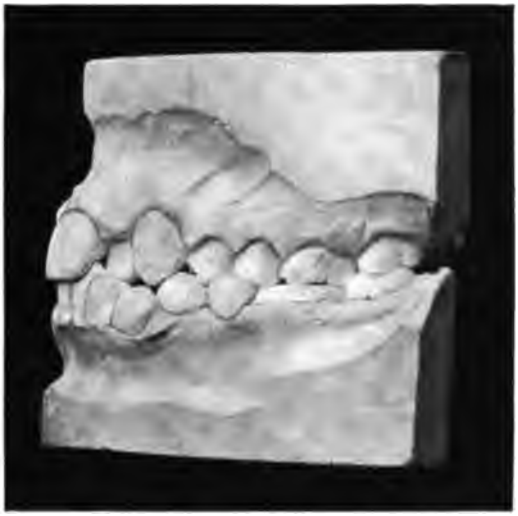

Fig. 41-A.

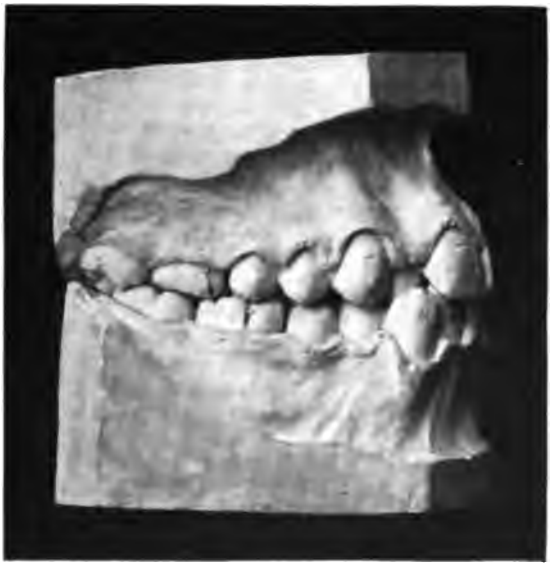

Fig. 41-B.

Class III, Subdivision. Unilaterally mesial relation of lower arch. Right side, normal; left side, mesial.

The facial deformity is very marked in these cases owing to the overdevelopment of the mandible and the underdeveloped premaxillæ.

Class III, Subdivision.—These cases are characterized by a mesial relation of the arch on one side and a normal relation, mesio-distally on the other (Fig. 41). The positions of the anterior teeth may resemble either of the types described under the division. Owing to one side of the arch being in normal mesio-distal relation and the other in mesial relation, there is a tendency for a cross-bite to be present in the region of the incisors, which produces a great amount of abrasion of the incisal edge of the incisors. Subdivision cases of Class III also cause an abnormal relation in the median line of the upper and lower arches.

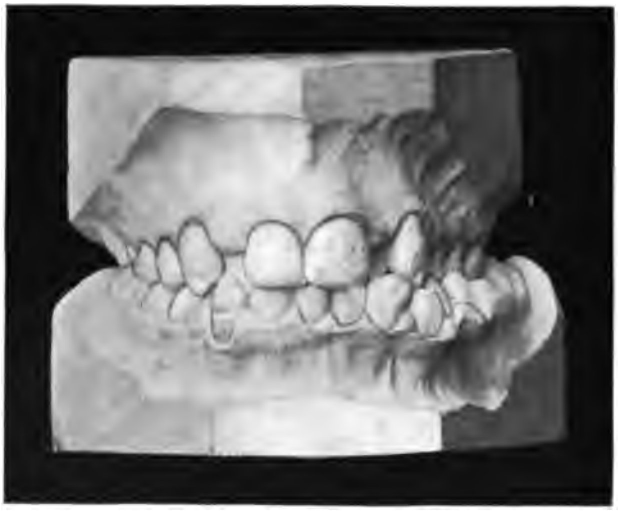

Fig. 41-C.
Front view of Class III, Subdivision.

There are some cases which are mesial on one side and distal on the other. This type of cases has been in-

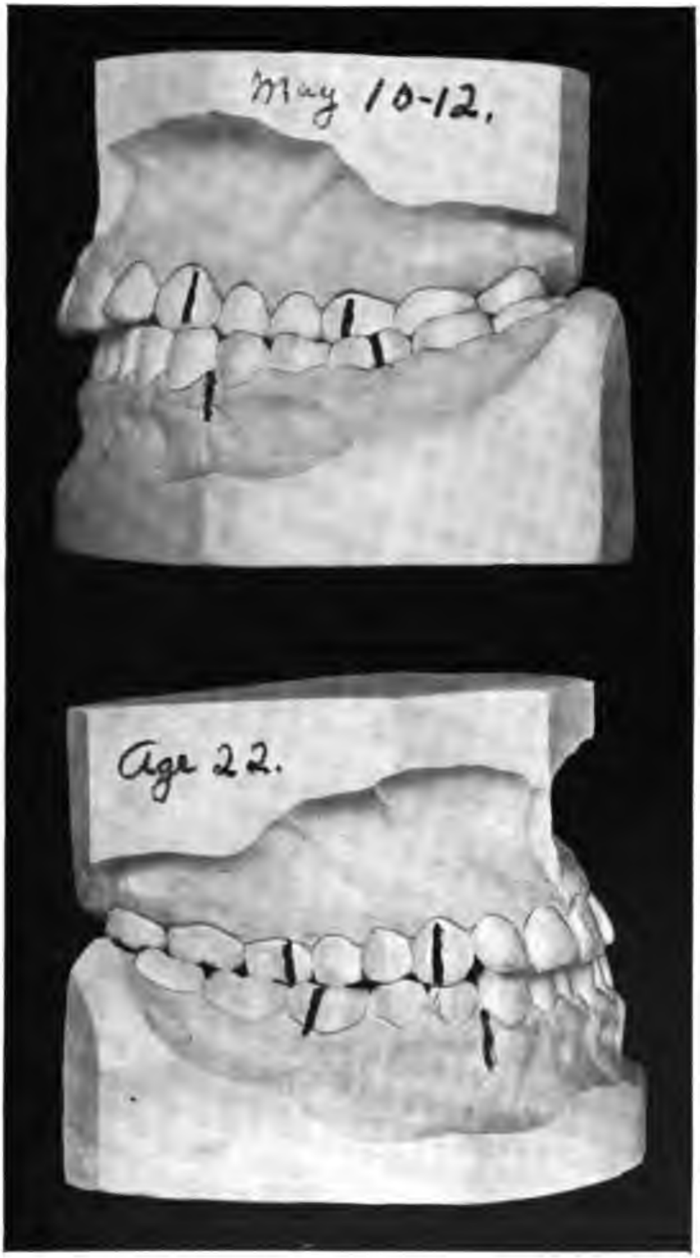

Fig. 42-A.
Unilaterally mesial and distal relation of lower. Incorrectly called Class IV.

correctly called "Class IV." The case shown (Fig. 42) is of that type. The etiological factors are not understood in regard to these cases. After a careful examination of this case, the author is convinced that the trouble was entirely with the relation of the teeth and not with the relation of the condyle to the glenoid fossa.

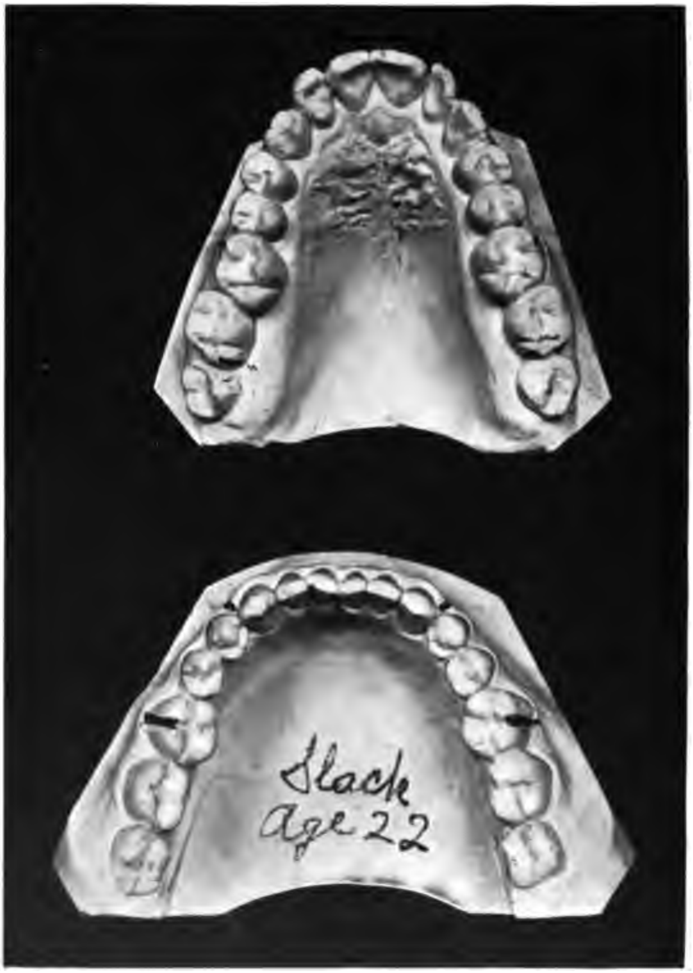

Fig. 42-B.
Occlusal view of case, with lower arch unilaterally mesial and distal.

Malformation of the Jaws and Their Processes, and Abnormal Relation of the Mandible to the Maxillæ.

In studying malocclusion it has been suggested that classification should be according to malposition of the teeth, malrelation of the arch, and malformation of the jaws and their processes.[3] The author can see no reason for the last classification mentioned or for one that will include the relation of the mandible to the maxillæ. After having examined a large number of patients and skulls, the author is convinced that the malformation of the jaws and their processes are the result of malocclusion of the teeth, except in such cases as are the result of accident, pathological growth, systemic conditions, and surgical operations. The argument in favor of the clas-

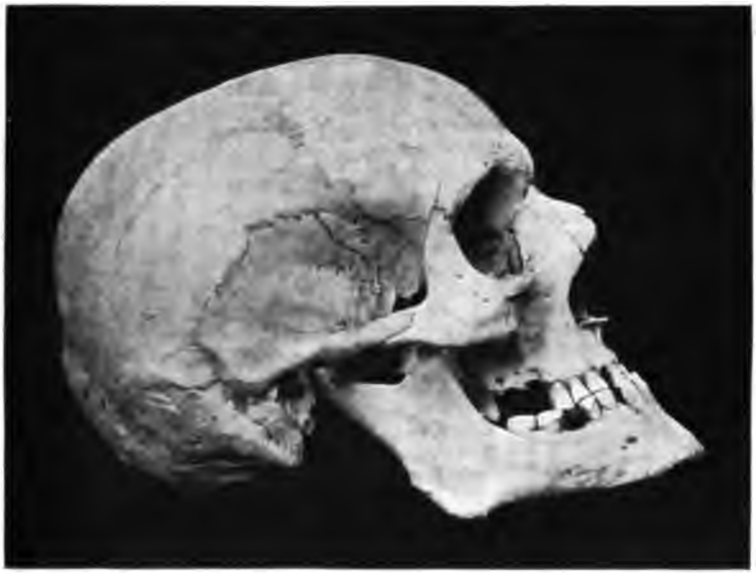

Fig. 43.
"Class III skull"—right side. Lower arch mesial to upper.

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[3] *See* Lischer's "Orthodontics."

sification which will take into consideration the relation of the mandible to the maxillæ, seems to rest upon the idea that in some Class II cases the mandible occupies a distal relation to the maxillæ, while in Class III the mandible is mesial. It is true that in Class II, Division 1, the chin is undersized and occupies a position too far to the distal, and in Class III, Types 1 and 3, the chin is too prominent; but those conditions are the result of underdevelopment and overdevelopment of the chin, caused by the malocclusion of the teeth, and the resulting disturbance of the forces of occlusion. In other words, the underdevelopment of the mandible in Class II, Division 1 and the overdevelopment in Class III is the result and not the cause of the malocclusion. We find some cases of Class III in patients of thirty years or

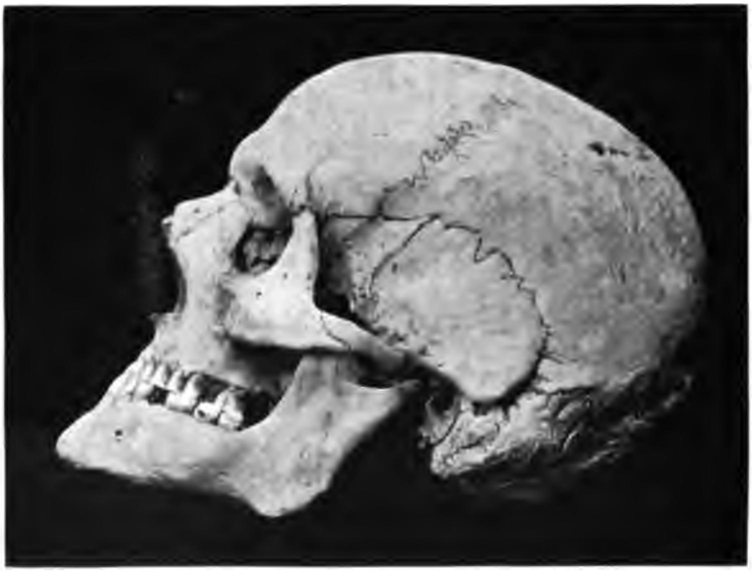

Fig. 44.
"Class III skull"—left side. Lower arch mesial.

more who have greatly deformed mandibles, which deformity has come on gradually and has been the result of the malocclusion.

There are a few authorities who claim that Class II cases are caused by the condyle occupying a distal position in the glenoid fossa, and that Class III cases are caused by the condyle being mesial to its proper relation. There is no evidence to prove that the condyle ever occupies a distal relation to the glenoid fossa and

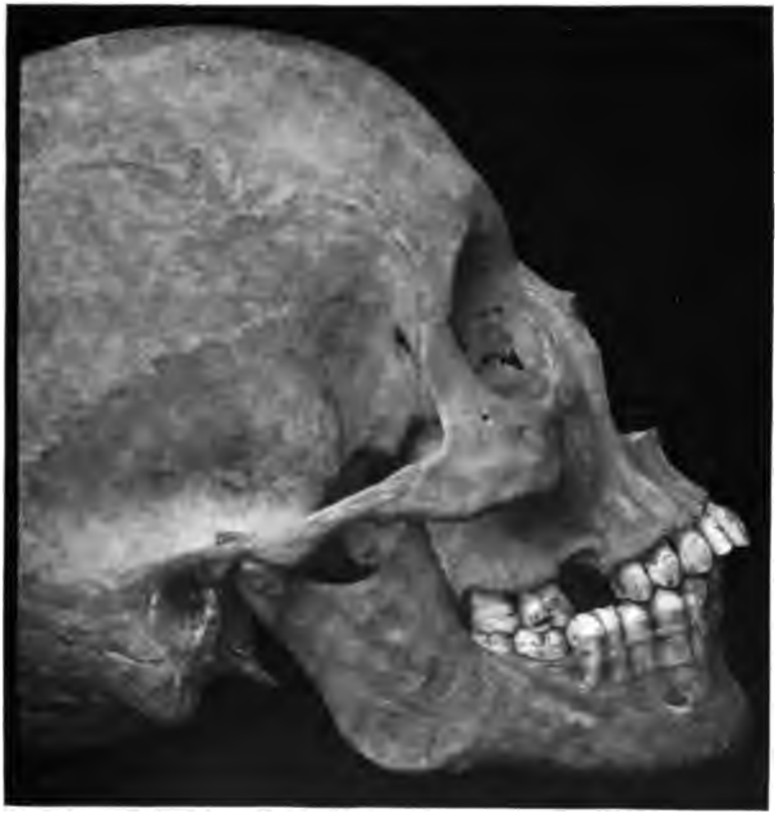

Fig. 45.
"Class II skull." Lower arch distal.

very little to suggest that it is mesial in Class III. In fact, the majority of evidence proves that the condyle always occupies its proper relation. In the examination of a large number of skulls, the author was unable to find one in which the condyle was mesial or distal to its normal anatomical position. Figs. 43 and 44 show the right and left side of a skull which has a Class III case of malocclusion, and Fig. 45 shows a Class II case. Fig. 46 shows a normal occlusion and the relation of the condyle to the glenoid fossa is the same in all cases.

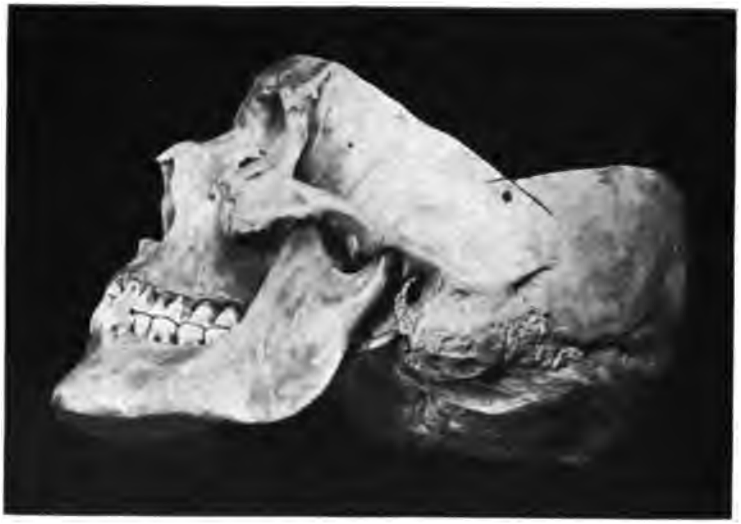

Fig. 46.
Normal skull.

There are skulls which show that the shape of the condyle and the glenoid fossa change during the life of the individual, but this has been produced by the change in occlusion of the teeth and the change has not affected the teeth whatever. The loss of certain teeth which cause the individual to masticate in a peculiar manner will produce a different shaped condyle on the two sides.

After considering all of the evidence that has been given on the malformation of the jaws and their processes, the author is of the opinion that the malocclusion of the teeth produces the abnormal jaw and process. The malocclusion is the cause of the deformed jaw and not the result.

CHAPTER IV.

ETIOLOGY OF MALOCCLUSION.

Etiological factors of malocclusion can be divided into two groups, local and general. General causes are also called constitutional causes.

General or Constitutional Causes.

General or constitutional causes of malocclusion include those that affect the general functions or metabolism of the individual to such an extent as to interfere with the development of the teeth or the surrounding structures supporting the teeth. There are a number of diseases which affect the general health of the individual to such an extent as to interfere with the normal forces of occlusion and therefore produce malocclusion. There are more general diseases that affect the development of the complete dental apparatus one way or another than was supposed to exist formerly. There are a few which produce conditions that are known to have a direct bearing upon malocclusion. First would be included all of those diseases of childhood which are accompanied with high temperatures. *Scarlet fever, measles, chicken-pox* and similar diseases are known to exert a deleterious effect upon the epithelial structures. They affect the formation of the enamel of the teeth to such an extent as to produce atrophy of the enamel organ, thereby causing a tooth which is faulty in shape, which in turn destroys the force of the inclined plane or the approximal contact. *Syphilis* has long been considered as a disease which produces atrophy of the enamel organ, and there is little doubt but that it does produce certain forms of crowns, which have been referred to as "Hutchinson's teeth," but there are also a great many other diseases which produce the same kind of crowns. In some cases the general disturbance may be so great as to destroy the tooth germ entirely, which would then produce a cause of malocclusion, namely missing teeth.

Rickets is another general disease which produces a great many cases of malocclusion. Rickets is a disease of malnutrition characterized by faulty bone formation. As a result of the faulty bone formation proper support is not provided for the teeth. The teeth being supported by a faulty calcified alveolar process, have not enough support to prevent them from assuming a position of malocclusion under the stress of mastication. The muscles of mastication exert force upon the bone which results in deformity of the bone. There is a general narrowing of the maxillæ and a widening of the mandible in the region of the ramus and the body of the mandible. The lower portion of the mandible is turned outward and the teeth are turned inward as a result of the force exerted upon them (Figs. 47, 48, 49). The deciduous teeth erupt late

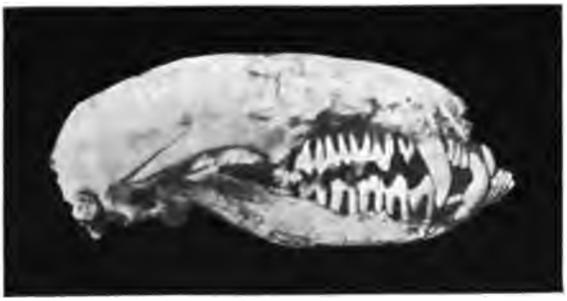

Fig. 47.
Skull of opossum which suffered from rickets. (Bibb's Collection.)

and are lost early. The roots of the deciduous teeth are absorbed early. There is a tardy eruption of the permanent teeth. Premature loss of the deciduous teeth, from whatever cause, always produces malocclusion. In a child suffering from rickets, these conditions produce malocclusions which are often attributed to some other cause later in life. We find the disease existing in various degrees of severity and as a result of this there will be varying degrees of the malocclusion. One of the things that produce malocclusion is the early loss of the deciduous teeth, regardless of what causes the loss of the teeth. When the early loss of the teeth is associated with the pathological conditions found in rickets plus the tardy eruption of the permanent teeth, a bad case of malocclusion is sure to develop.

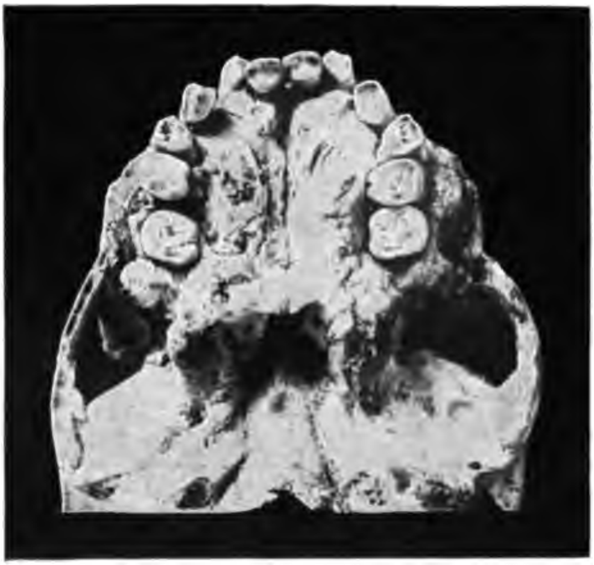

Fig. 48.
Superior maxillæ of ape who died from rickets. (Bibb's Collection.)

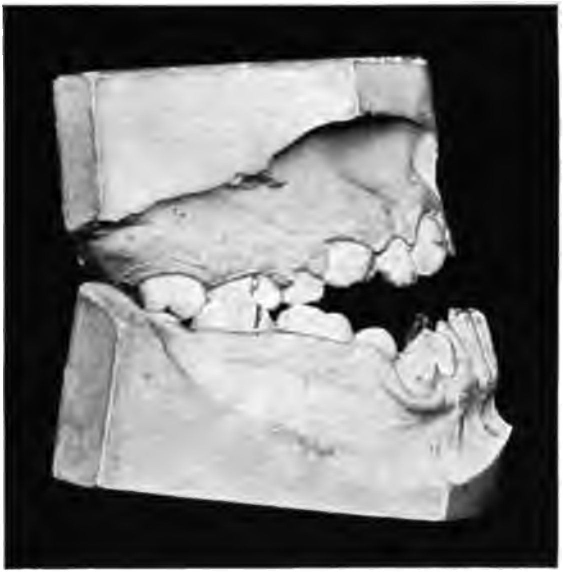

Fig. 49-A.

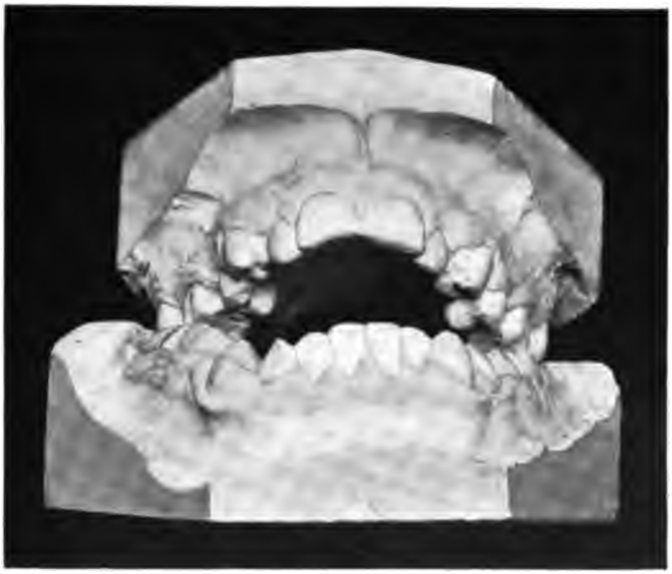

Fig. 49-B.
Malocclusion in which there was a history of rickets.

Tuberculosis also produces conditions which affect the teeth but they are not as severe as those produced by rickets and the results are almost directly opposite. A child suffering from tuberculosis will erupt the deciduous and permanent teeth early. After a deciduous tooth takes its place, the root will not be absorbed as it should and the permanent tooth will take a position somewhere to the side of it. However, the deformity caused by the prolonged retention of a deciduous tooth does not produce the harm that the early loss of the deciduous tooth would produce.

The reason why these two constitutional diseases should act as they do has not been fully explained, but a great many confining their practice to the diseases of children have tabulated the conditions as herein mentioned.

Another constitutional condition producing malocclusion is the *faulty development* of the child, which may be the result of several conditions. First would be named, improper food, which does not mean a scarcity of food but a lack of the proper kind. The children of the better class are more apt to suffer from this cause than those of the middle class who are forced to eat a coarser food and one which generally contains more bone building elements. In this connection we could also mention the lack of mastication, which is in some cases the result of food being prepared so as to prevent mastication. This lack of mastication and its evil effect upon the development of the dental arches has been classed as "disuse." These conditions might also be called the result of the environment in which the modern child lives. The children of the better class of people do not use their teeth enough to produce a good healthy circulation of the blood to the surrounding structures, which results in a lack of development of the dental arch about the time that the deciduous teeth are being lost and the permanent teeth are erupting. Fig. 50, showing the jaws of an old Indian, illustrates the effect of use and the well development of the parts. The mistake must not be made of attributing all malocclusions to disuse and environment when some local cause may be responsible.

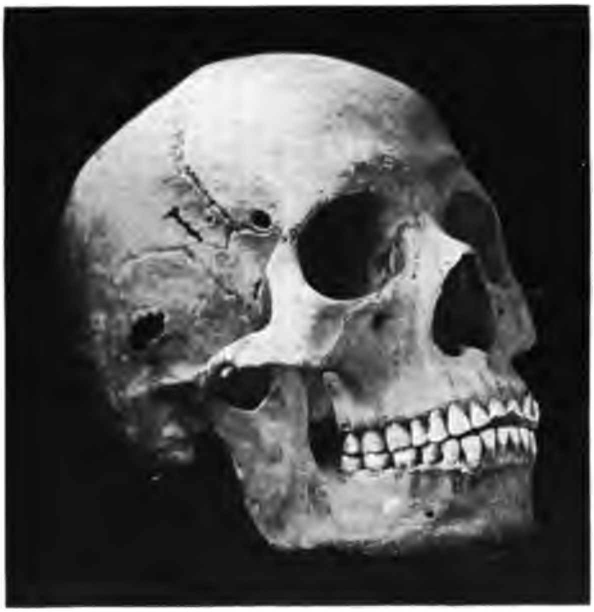

Fig. 50.
Showing well-developed jaws and wear of teeth as a result of use.

Local Causes.

Local causes of malocclusion are those which act directly within the oral cavity and its parts. They include such conditions as affect the teeth and surrounding structures. At first it would seem easy to separate local from constitutional causes and a number of those conditions are easily separable. However, there are other conditions which may be said to be both local and

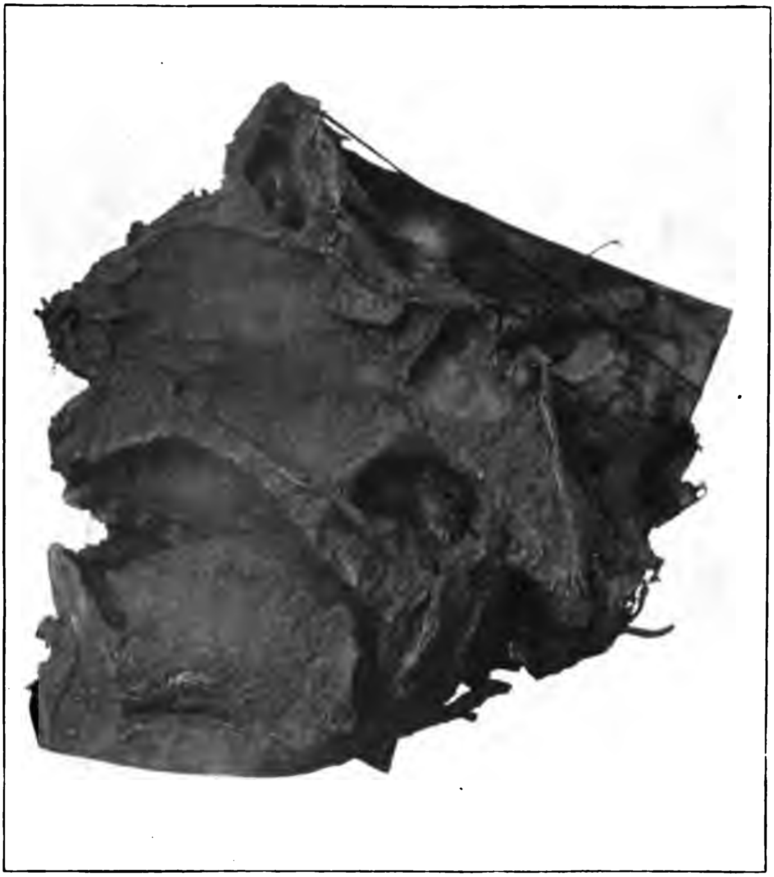

Fig. 51.
Showing naso-pharynx, hard and soft palate, and location of adenoids shown at X.

constitutional, and it is hard to tell which may have been the primary cause. In discussing constitutional causes, we stated that rickets caused an early loss of the deciduous teeth and the tardy eruptions of the permanent teeth. These two things would act locally while the cause of them would be constitutional. But, as before stated, these local conditions are the result of a constitutional condition. Mouth-breathing has long been given as a local cause of malocclusion because it disturbs the muscular and atmospheric pressure and acts directly upon the surrounding structures. The majority of cases of mouth-breathing are caused by hypertrophy of the lymphoid tissue located in the naso-pharynx, also known as the pharyngeal tonsil (See Fig. 51). Therefore the real cause of the mouth-breathing is the adenoids which may be the result of a constitutional condition or of the environments in which the child is living. The local disturbance is the direct cause of the malocclusion, but the factor which caused the adenoids may have been overlooked. When we look at some causes in this light, we are forced to admit that the line between the local and constitutional causes blends together to such an extent as to be almost inseparable. However, the majority of malocclusions are surely the result of local disturbances or the result of environment. As there are a great number of local causes, this subject will be discussed more thoroughly later. We will now take up a different plan of classification of causes.

Inherited, Congenital and Acquired Causes.

The causes of malocclusion can be divided again into three groups, according to the time in which they originate or according to the source of origin. They are hereditary or inherited, congenital and acquired.

Inherited Causes.—An inherited condition is one that is transmitted from the parent to the child. An inherited malocclusion would be one that was present in the parent and transmitted to the offspring. Owing to the fact that much has been written on the inheritance of malocclusion, it will be necessary to review some of the theories for and against, as advocated by authorities formerly and at the present time. The evidence may be divided into biological and clinical. From the standpoint of biology, anatomy, histology and embryology, there is no evidence that malocclusion is ever inherited. The author has never seen a single case of malocclusion which was not the result of some congenital or acquired cause. A child inherits a great many things from its parents. It inherits a great many characteristics. A child with white parents is white; a child with negro parents is a negro; a bird hatched from a duck egg will be a duck and one from a chicken egg will be a chicken. A child also inherits certain conditions which have been the result of environment working upon the human race for a great number of years. A child inherits a certain number of things which make up the dental apparatus. The teeth are so arranged as to be in normal occlusion. Any deviation from normal occlusion is the result of some acquired or congenital condition. It is a well-known fact that characteristics which arise spontaneously and are spoken of as variations are not as a rule transmitted unless they are a decided advantage to the offspring. Any variation which is not impressed upon the germ cell will not be transmitted. Each individual germ cell possesses a certain amount of chromatin which presides over inheritance. In order for a child to inherit malocclusion, the malocclusion must be impressed upon the chromatin of the germ cell. We have no evidence that such a thing can occur. After the union of the male and female pronucleus, the embryo develops as a separate organism in which is contained the sum total of all the characteristics carried by the male and female germ cell. The offspring may resemble one or the other of the parents, or may be a blending of the two; if a blending of the two, the offspring will not exactly resemble either parent. The author does not feel that any other condition can occur, as no other conditions except those above mentioned can be found anywhere in biology. On the other hand, those who advocate the inheritance of malocclusion, and a certain number of men do, claim that certain types of malocclusion are transmitted.

One type is called *family traits.* They refer to such conditions as the protruding of the lower teeth or Class III cases, or protrusion of the upper teeth or Class II, Division 1. We do find Class II, Division 1 cases in parents, uncles and aunts, and sometimes in several of the children, but it has not been the result of inheritance. These cases have been produced because each one of those individual children and each one of their parents, uncles and aunts who have Class II, Division 1, have lived in exactly the same environments and the same pathological conditions have been acquired as a result of those environments, which has disturbed the forces of occlusion so as to produce that particular type of malocclusion. Therefore, such conditions as are grouped under the head of family traits by other authors are not the result of the transmission of the malocclusion, but the result of acquired conditions which are the same in each individual.

We find another class of conditions mentioned by those who advocate the inheritance of malocclusion, which class has been called the *"intermarriage of races"* or the *"mixing of types."* They explain a certain number of malocclusions which are very often found to be the result of the marriage of parents who are of different physical size. For instance, they say that a child will often inherit the teeth of a large father and the jaws of a small mother, resulting in a condition in which the teeth are too large for the jaws. No explanation has ever been made as to how such a condition could occur. To any one who is familiar with the development of the teeth and jaws it becomes absolutely impossible to accept such a doctrine. The child's teeth are not formed from one group of cells and the jaws from another, but both come from the branchial skeleton, and up to a certain time it is impossible to say which cell is going to develop into a tooth and which cell is going to develop into the jaws or bone supporting the teeth. The size of the child's teeth was determined at the time of the fertilization of the ovum. From that time on until the eruption of the permanent teeth, if the child leads a perfectly normal life, and is not influenced by any other acquired cause or constitutional disease, the arches will be large enough for the teeth. The size of the teeth, that is, the enamel of the teeth, will not be changed unless there is an actual destruction or atrophy of the enamel organ. However, the size of the bone or the jaw supporting the teeth depends upon the environment of the individual, and there are a number of conditions which will retard the development of the jaws and produce malocclusion of the teeth. The author has never seen a case of malocclusion that has been the result of inherited conditions nor has he ever had an opportunity to inspect a case in which the malocclusion of a parent was transmitted to the offspring.

Congenital Causes.—Congenital conditions are those which occur in the embryo before birth. There has been some dispute as to the meaning of inherited and congenital conditions. Some writers have used the terms synonymously. It may be said that all inherited conditions are congenital, but congenital conditions are not always inherited. In other words, there are some congenital deformities of the parents which will not be transmitted to the offspring.

The most frequent congenital conditions which have to do with malocclusion of the teeth, are hare-lip and cleft-palate. *Hare-lip* and *cleft-palate* occur in a certain number of cases in each community, that is, they occur as "the result of average." If a thousand cases were examined in one community, a thousand individuals in another community, and a thousand in the third, we would find about the same number of hare-lips and cleft-palates in all three communities. We would find just as many cases of hare-lip and cleft-palate in one family as we would in another. At certain times the average may run up and at others it will be diminished. We may find a few cases where the parents and some of the children in the same family have hare-lips, but after that there might be generations and generations in which these deformities would not appear. Hare-lip and cleft-palate is simply an improper union of the premaxillæ with the maxillary bud, and these conditions exist in all individuals at some time in embryonic life. Some disturbance which occurred during the intra-uterine life produces a failure of union of these parts. It has been observed that the majority of hare-lip and cleft-palate cases occur in the first-born children, and hardly ever are these conditions seen in children born afterwards. Some authorities claim it is caused by improper stress which has forced the maxillary and premaxillary bones apart and prevented them from uniting.

Another congenital condition is *supernumerary* (Figs. 52 and 53) and *missing teeth* (Figs. 54 and 55). We find the supernumerary tooth germ present before birth and in the majority of missing teeth germs are absent at birth. A few cases of missing teeth will be found resulting from accident or disease after the birth of the child, in

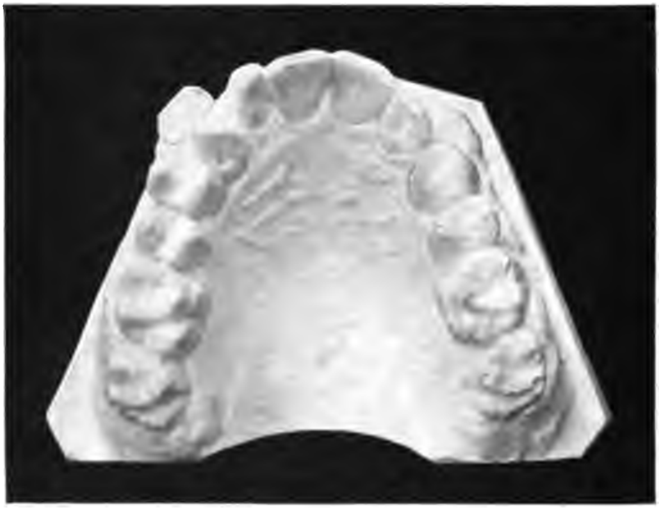

Fig. 52.
Supernumerary teeth, congenital cause of malocclusion.

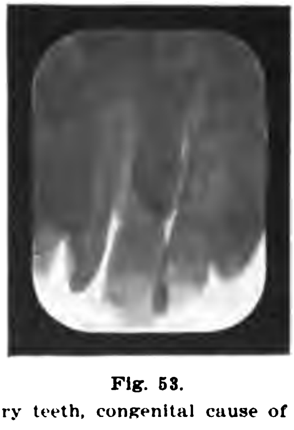

Fig. 53.
Supernumerary teeth, congenital cause of malocclusion.

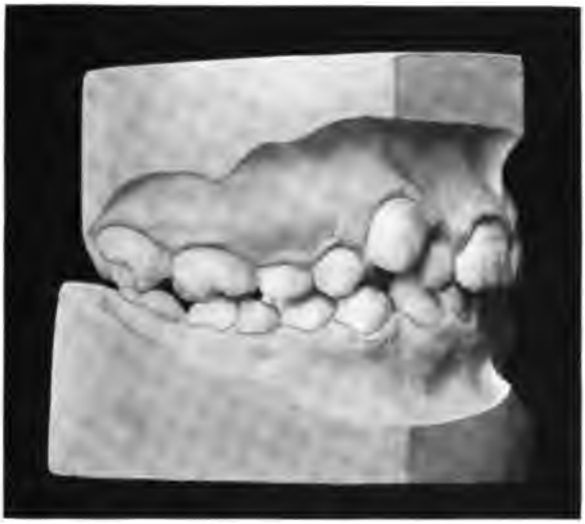

Fig. 54-A.

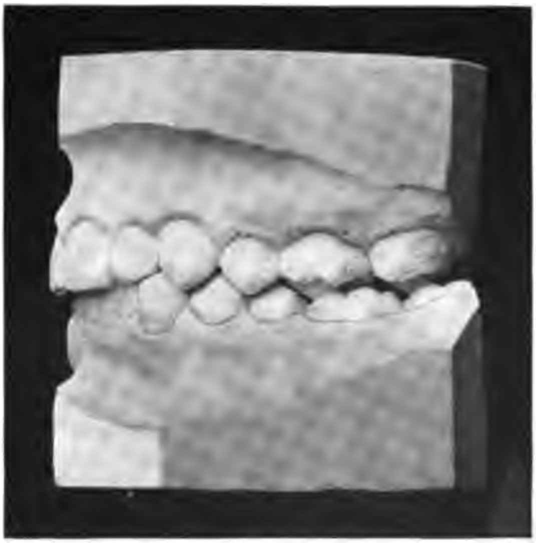

Fig. 54-B.
Missing tooth (upper second premolar), congenital cause of malocclusion.

which case the condition would not be congenital. The lateral (Fig. 56) incisors and premolars are most frequently absent.

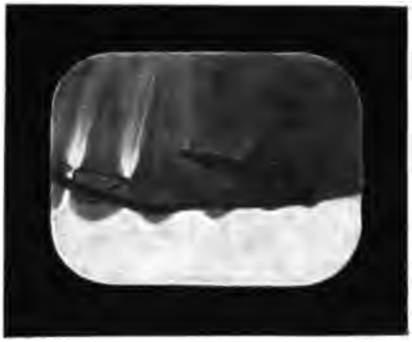

Fig. 55.
Congenital missing upper second premolar.

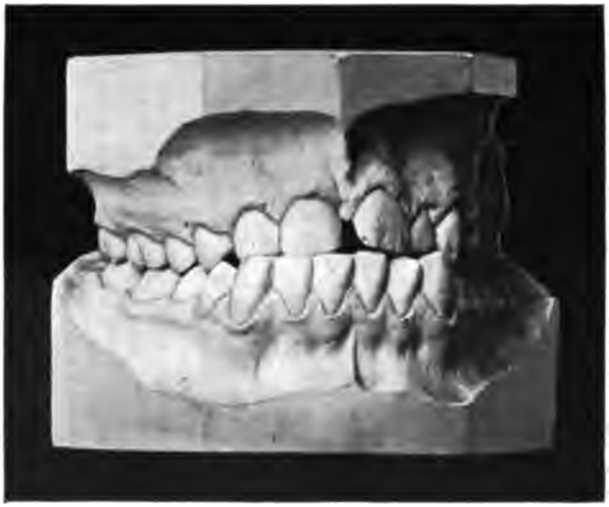

Fig. 56.
Missing lateral incisor, congenital cause of malocclusion.

Abnormal development and attachment of the frenum labium (Fig. 57) is also congenital, although in a great many cases this condition does not assert itself until some time after birth. Other congenital conditions may be *large* or *oversized tongue* (Fig. 58), or *undersized tongue;* although the latter condition occurs very rarely and complete data in any great number of these cases has not yet been worked out.

Acquired Causes.—Acquired causes of malocclusion are those which occur after the birth of the individual. They are the result of the environment in which the individual lives. Acquired causes may be either local or constitutional. The majority of conditions which produce malocclusion of the teeth come under the head of acquired causes. Therefore, in describing acquired causes it must be remembered that some of them are local and some constitutional.

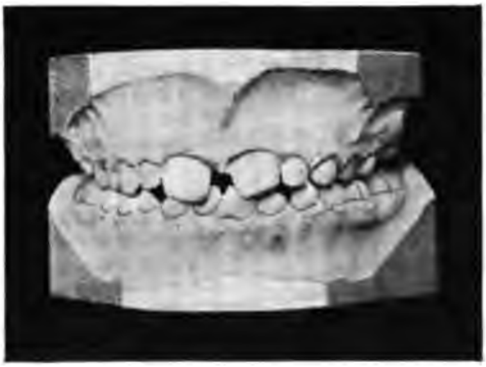

Fig. 57.
Abnormal frenum labium, congenital cause of malocclusion.

Early Loss of the Deciduous Teeth.

The early loss of the deciduous teeth may be constitutional, as, for instance, when it is associated with rickets; or it may be local when associated with decay, or early extraction. Malocclusion is bound to develop regardless of whether the deciduous tooth has been lost as a result of local or constitutional conditions. The early loss of a deciduous incisor, above or below, will

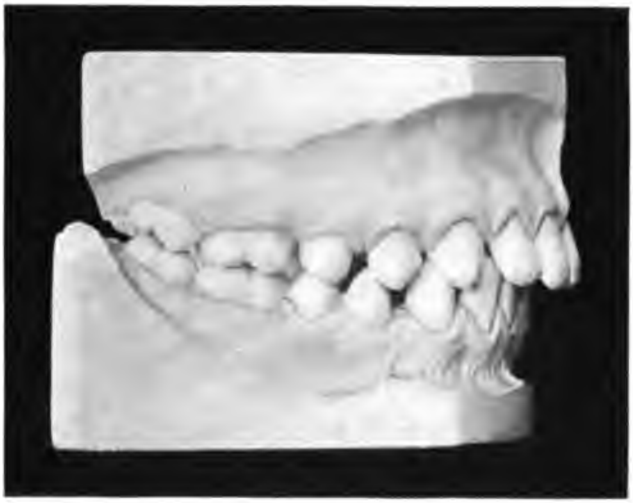

Fig. 58-A.

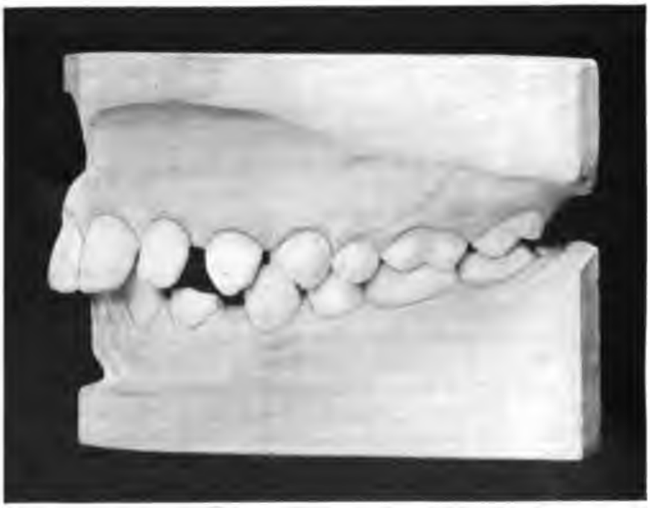

Fig. 58-B.
Result of oversized tongue, which may be congenital.

produce a lack of development in the region of the incisors (Fig. 59). The loss of the force of the approxi-

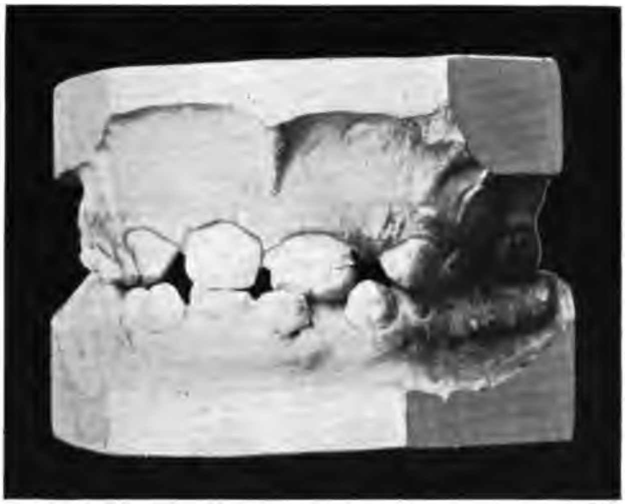

Fig. 59.
Malocclusion produced by early loss of deciduous incisors.

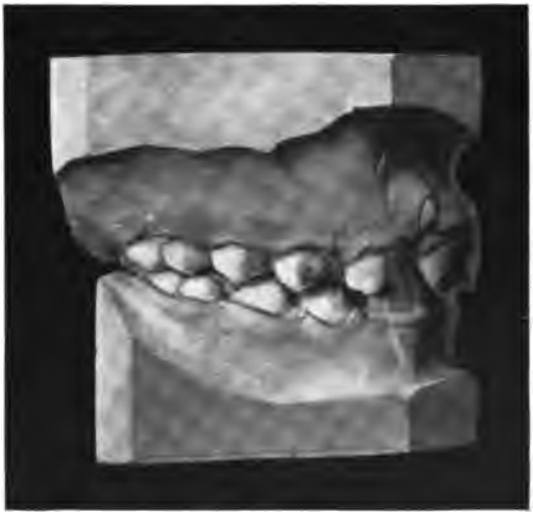

Fig. 60.
Early loss of deciduous lateral has allowed upper central to drift toward the right side. Lower lateral is nearly in contact with deciduous molar.

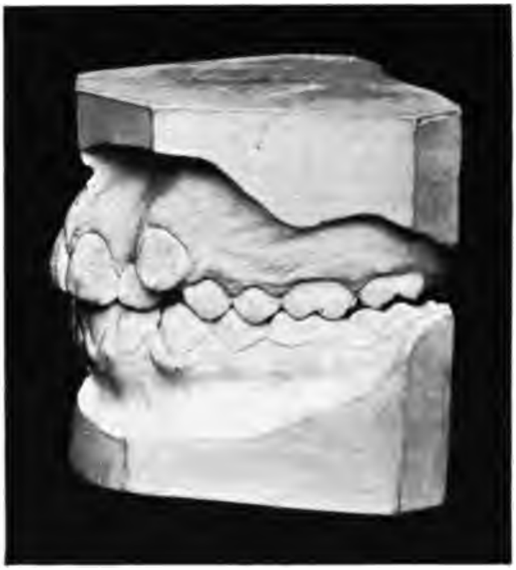

Fig. 61-A.
Upper canine out of line because of early loss of deciduous canine.

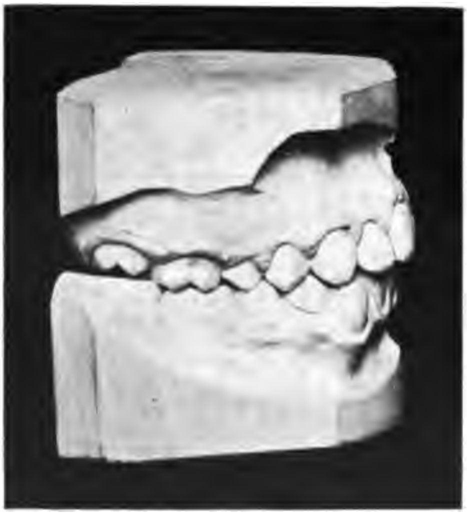

Fig. 61-B.
Lower canine crowded labially because of contracted arch due to early loss of deciduous canine.

mating teeth will permit them to drift together. The early loss of an upper or lower deciduous canine will permit the incisor to drift toward the side from which the tooth is missing (Fig. 60) until very often the lateral incisor comes in contact with the first deciduous molar. As a result the dental arch will be too small to accommodate the permanent canine, which will appear as in Fig. 61. The loss of a deciduous molar will permit the permanent molar to drift forward (Fig. 62). This will result in an abnormal mesio-distal relation of the first permanent molar and will also often result in impaction of the premolar when it attempts to erupt (Figs. 63 and 64). Given the loss of any of the deciduous teeth, it is possible to describe the malocclusion which will result in a few years from that time.

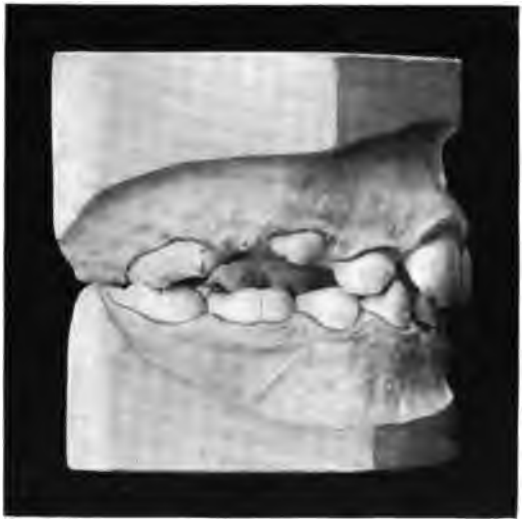

Fig. 62.
Early loss of deciduous molar has allowed permanent molar to drift forward.

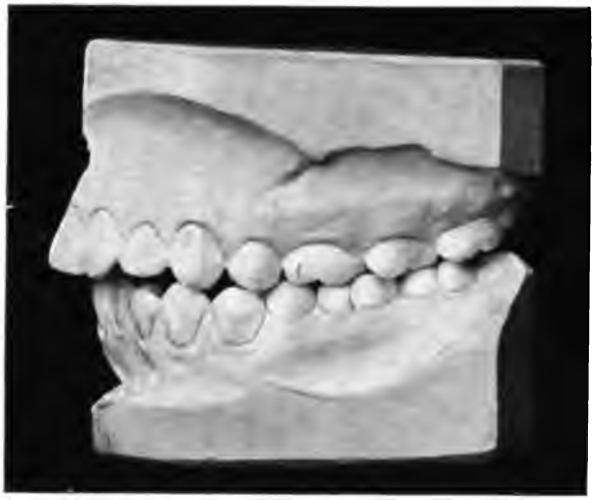

Fig. 63.

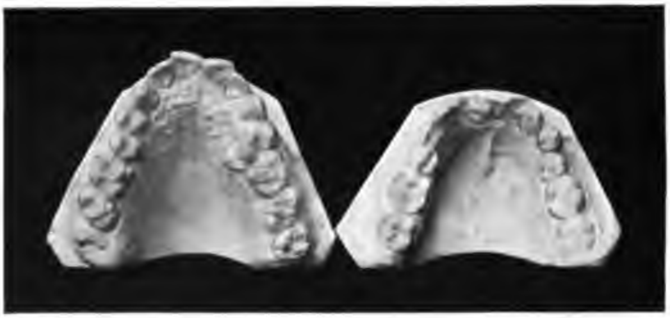

Fig. 64.
The upper molars have taken a mesial position as a result of the early loss of the deciduous molar and the premolar is impacted as shown in Fig. 64.

Tardy Eruption of the Permanent Teeth.

Tardy eruption of the permanent teeth is an acquired characteristic very often the result of a constitutional disease, namely rickets; or it may be the result of a poor physical development which prevents the proper calcification and eruption of the teeth. If the deciduous teeth have been lost, either as the result of constitutional disease or as a result of local cause, the space which remains vacant by the permanent tooth not erupting will be closed by other teeth drifting towards each other, because of the loss of the approximal contact. The longer the permanent teeth are delayed in eruption the more complicated becomes the malocclusion.

Early Loss of the Permanent Teeth.

Early loss of the permanent teeth produces a large percentage of malocclusions found in adults, and malocclusion will result from the loss of any permanent teeth at an advanced age. The early loss of the first permanent molar (Figs. 65 and 66) produces a malocclusion which is very difficult to treat, which does a great deal of damage to the occlusion of the teeth, destroys the masticating apparatus of the patient, and is a predis-

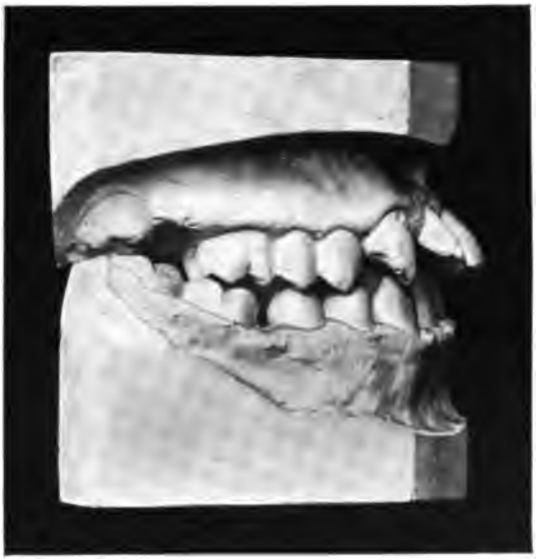

Fig. 65.
Loss of permanent molar acquired cause of malocclusion.

posing factor to pyorrhœa. Malocclusion is sure to result irrespective of the age at which the first molar is lost; neither does it make any difference whether the lower and upper molars are lost on the same side or on opposite sides (Fig. 67); or whether one or all of them are lost. The malocclusion will result, and result in such a positive manner that it is possible to foretell what is going to take place by knowing the time at which the molar is lost. Some authors have advocated the extraction of the first permanent molar for the correction and prevention of malocclusion, explaining that the second molar would move forward and take the position occupied by the first molar. That is a false theory, and one that has caused no end of trouble. Loss of the lower first molar permits the lower second molars to tip forward half the width of a tooth (Fig. 68), and the teeth anterior to the lower first molar will drop back half of the

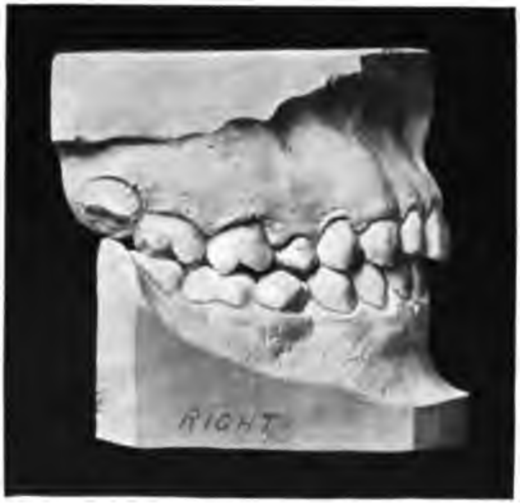

Fig. 66.
Loss of lower first molar.

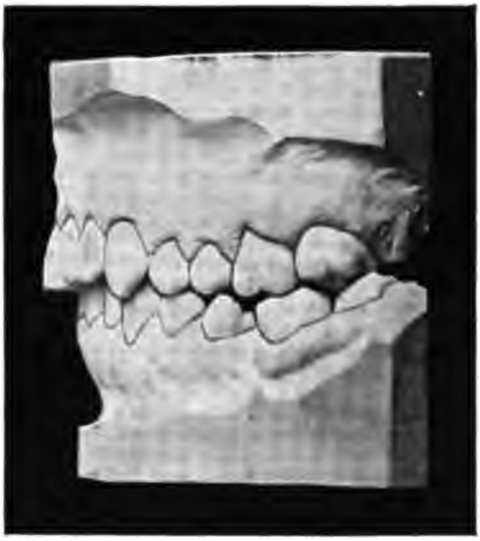

Fig. 67.
Loss of lower and upper first molars.

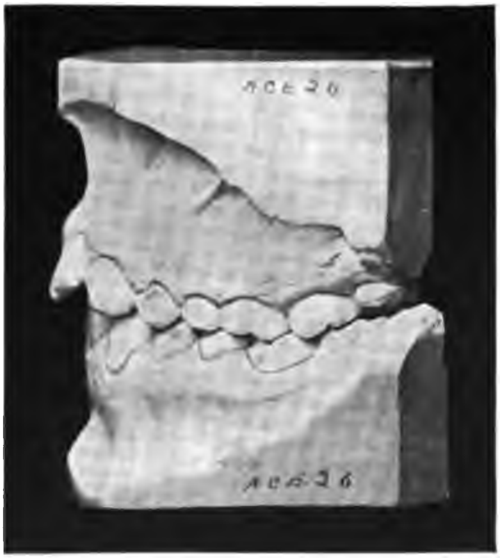

Fig. 68.
Loss of lower first molar at early age.

distance (Fig. 69), which will destroy the occlusion on that side of the mouth. In addition to that malocclusion

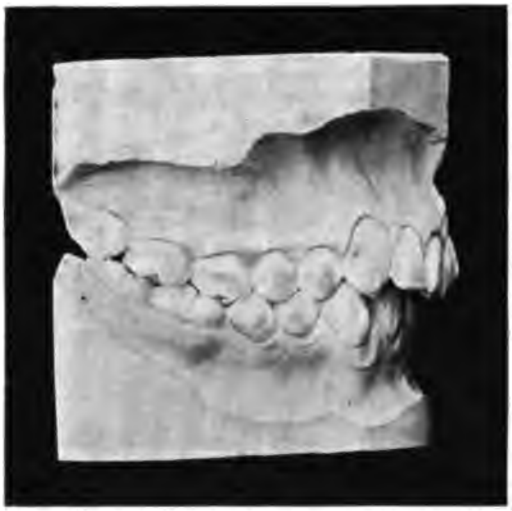

Fig. 69.
Malocclusion produced by loss of permanent lower molar.

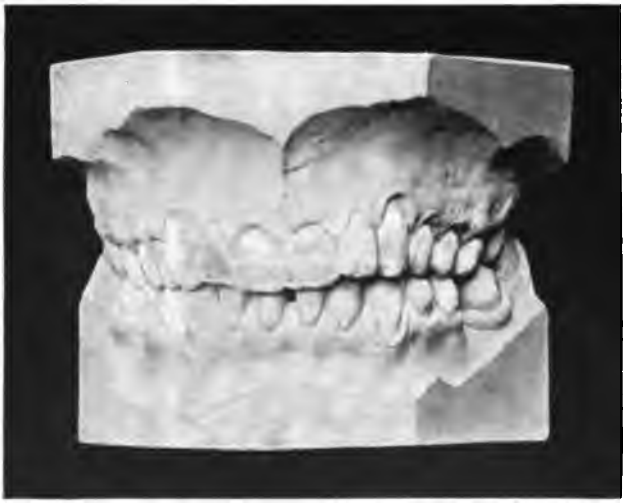

Fig. 70.
Excessive over-bite produced as a result of extraction of lower permanent molars.

there will occur an overlapping of the upper anterior teeth and the lower incisors will drop distally (Fig. 70) so far as to occlude against the gingival of the upper teeth. The facial deformity that is produced is one in which the chin is too close to the nose (Fig. 71). The loss of both lower first molars would simply make the malocclusion more pronounced and the facial deformity more noticeable. The loss of all four first molars would produce a very similar type of malocclusion, destroy the approximal contact of all of the teeth and ruin their masticating efficiency, bringing about an inharmonious expression of the face. The reason the loss of all four first molars destroys the approximal contact point and the facial expression, with a tremendous loss of masticating efficiency, is because the upper and lower first molars have entirely different shapes and are different in mesio-distal diameters.

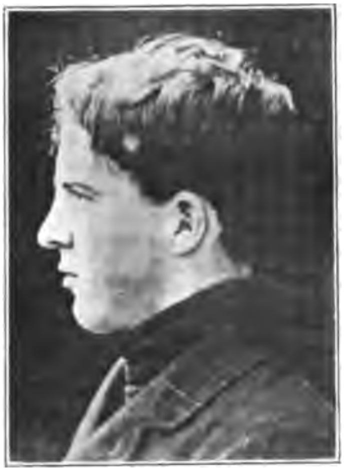

Fig. 71.
Facial deformity caused by loss of lower first molar in Fig. 68.

The Loss of the Mesio-Distal Diameter of the Teeth.

Malocclusion will result by the premature loss of the deciduous or permanent teeth, because the approximal contact of that arch has been destroyed, which results in a mesio-distal shortening of that particular lateral half. The loss of the mesio-distal diameter of the lateral half of the arch is not as great as the loss of the entire tooth. The loss of the mesio-distal diameter of the tooth is generally the result of caries with improper treatment of the same. A large number of malocclusions are produced because of the loss or decrease of the mesio-distal diameter of the deciduous molars. It is a well-known fact that the deciduous molars are wider mesio-distally than the premolars. This has caused many to wrongfully believe that it is possible to allow the mesio-distal diameter of the deciduous tooth to become less than normal without producing any serious effect. This is not true. The loss of a mesio-distal diameter of a deciduous molar as a result of caries will always result in the displacement of the first permanent molar. If the loss is still greater it will result in the impaction of the premolar. Therefore, to avoid the loss of the mesio-distal diameter of deciduous teeth it becomes necessary that the treatment be such as will retain the original diameter. They should be filled with some substance that will maintain this mesio-distal diameter. The tooth must be restored to the original shape, size, and proper contour. It very often follows, in mesial or distal approximal cavities which have been present for some time in molars and premolars, that the teeth have drifted together, destroying the mesio-distal diameter of the tooth and the mesio-distal length of the arch. As a result of the loss of the mesio-distal diameter of the teeth, the cusps will not occlude properly and there will be inharmony in the size of the arches.

Improper Restoration.

We have mentioned the loss of the approximal contact of the deciduous teeth which destroys the mesio-distal diameter of the teeth and the same can be said of conditions found in the permanent teeth. We should also call special attention to improper restorations of the same. Very often such restorations are not properly made so as to replace the mesio-distal diameter, and fillings and inlays do not always have the proper shaped approximal contact point. The force of the approximal contact point is one of the normal forces of occlusion, and failure to properly restore contact is a cause of malocclusion. The occlusal surfaces of the teeth are not always properly restored, thereby destroying the force of the inclined plane. A great many cases of malocclusion are the direct result of improper restoration of the teeth as well as improper occlusal surfaces of crowns and bridges.

Mouth-Breathing.

Mouth-breathing has long been recognized as a cause of malocclusion, and is generally the result of adenoids. There are other things which cause mouth-breathing, but the large percentage in children is produced by adenoids. Adenoids may be defined as the hypertrophy of the lymphoid tissue located in the naso-pharynx. Lymphoid tissue is present in all children and becomes the cause of mouth-breathing only when it is infected and congested to such an extent that it extends downward and forward until it comes in contact with the soft palate and closes the naso-pharynx. In some children this congested condition becomes sufficient to produce an obstruction of the nasal tract only when lying down. The mass of lymphoid tissue mentioned above is only a portion of a continuous ring which encircles the pharynx and is known as the ring of Waldeyer. Owing to the ease with which this ring of lymphoid tissue becomes infected it is also known as the vicious circle. The enlargement of the mass of lymphoid tissue in the naso-pharynx posterior and above the soft palate, can only be seen by the use of reflected light and a pharyngeal mirror. However, the clinical picture of the patient is enough to prove the presence of adenoids to one familiar with the conditions. The patient has a "vacant stare" which is better described as follows: the upper lip is short; the external nares undeveloped; lack of development through the nasal region; antral cavities are undeveloped, which gives a narrow face; mandible underdeveloped; poorly developed chin. The eyes often appear large and staring, which is the result of the lack

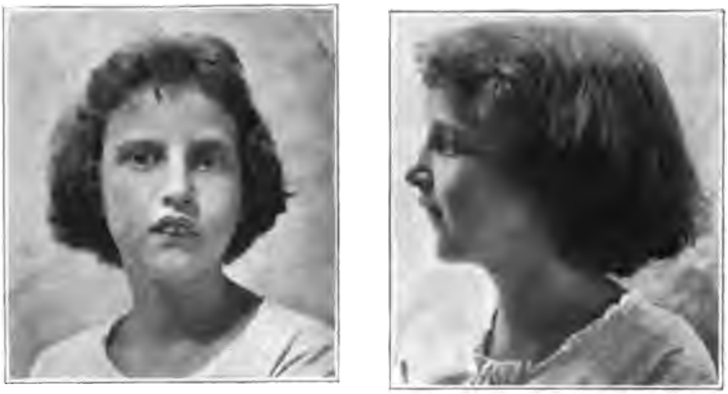

Fig. 72-A. Fig. 72-B.

Facial deformity caused by mouth-breathing.

of development of the nasal regions. Fig. 72 shows the appearance of a patient who is a mouth-breather as the result of adenoids. Patients suffering from this condition all present the same picture. Fig. 73 shows a

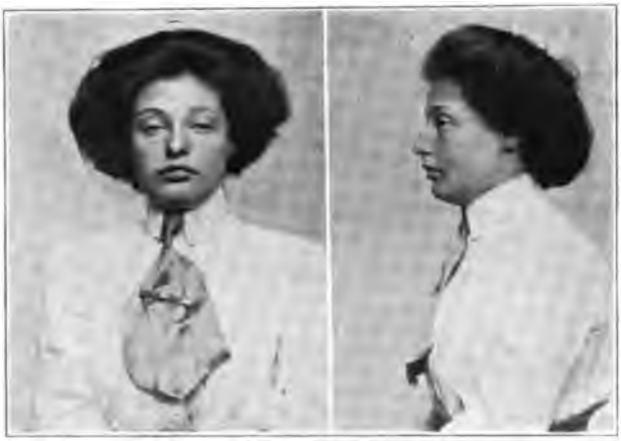

Fig. 73-A. Fig. 73-B.
Facial deformity of older patient caused by mouth-breathing.

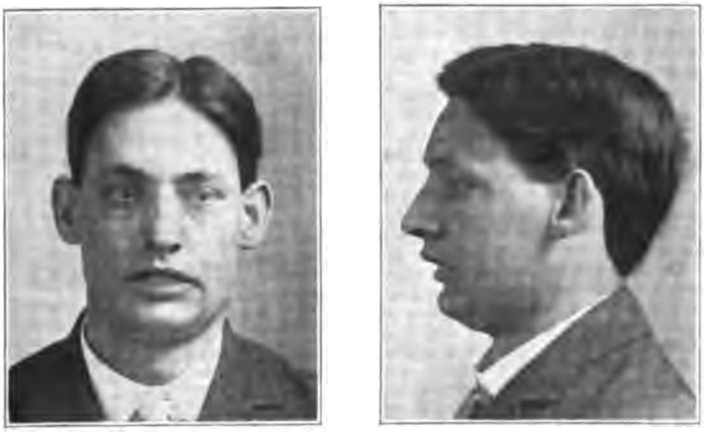

Fig. 74-A. Fig. 74-B.
Facial deformity caused by mouth-breathing.

case somewhat older. As these patients grow older, the condition becomes more marked and in adults the deformity is great (Fig. 74).

Owing to mouth-breathing, air does not pass through the nasal cavities and as a result no atmospheric pressure is exerted upon the walls of the nose. The relation of the bony walls of the nose is shown in Fig. 75, made from an embryo at birth. At this age the maxillary sinus is not seen and the roof of the mouth is nearly straight. The inferior turbinated bone lies close to the floor of the nose. If the child breathes normally, the

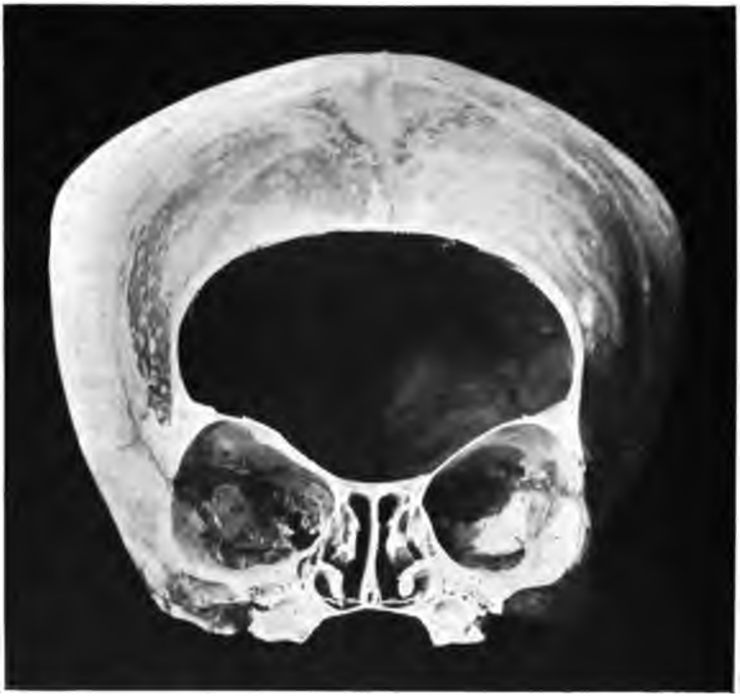

Fig. 75.
Shape and relation of nasal cavity and roof of mouth at birth. Note absence of maxillary sinus.

nasal cavity will develop, the floor of the nose will be carried downward and the septum will have room to grow. The growth of the nasal cavity affects the growth of the maxillary bone, and likewise anything which affects the growth of the maxillary bone will influence the oral cavity. Fig. 76 shows the maxillary bones, and it will be seen that about three-fourths of the lateral walls and four-fifths of the floor of the nose is made up of the superior maxillary bones. It is therefore easy to understand how the lack of development of the nasal cavity will influence the maxillary bone and how the lack of growth of the maxillary bone will influence the nasal cavity. As the child grows, the nasal cavity increases in size and grows downward and outward until in the adult

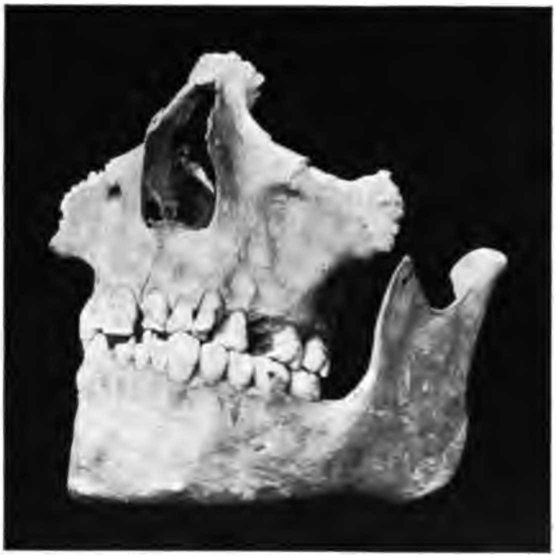

Fig. 76.
Maxillary bones, showing large amount of nasal cavity formed by maxillary bones.

we find conditions as shown in Figs. 15 and 77, the force of atmospheric pressure acting as a force to cause the

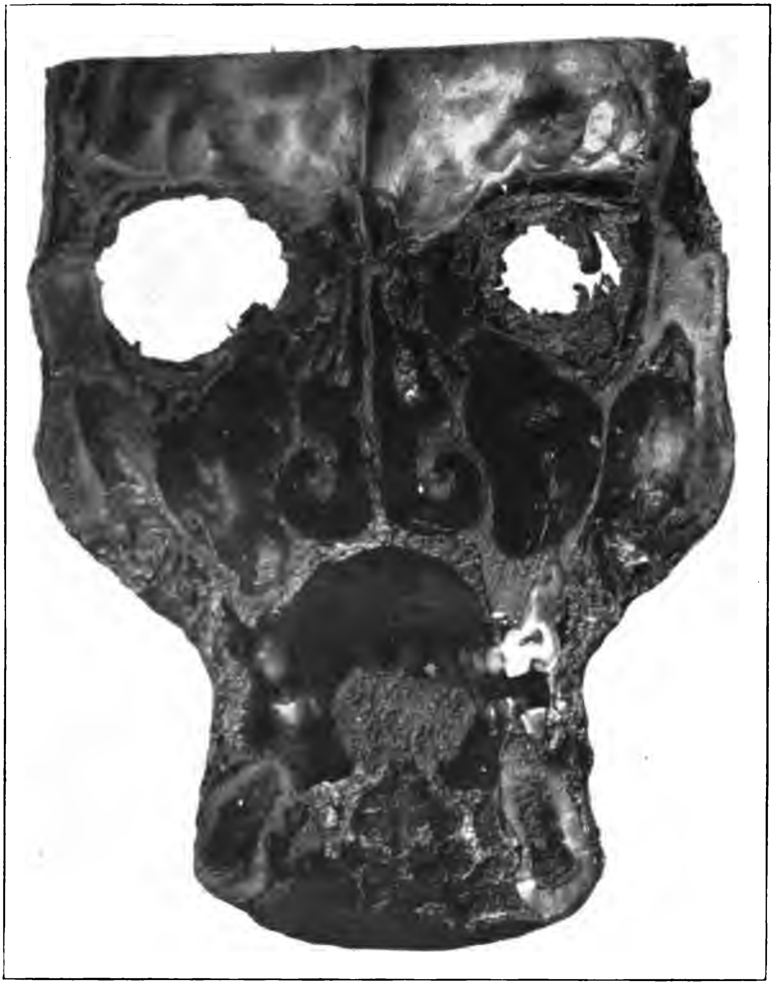

Fig. 77.
Relation of nasal and oral cavities in the adult. Compare with Fig. 75.

normal development of the nasal and oral cavities. Muscular pressure also plays an important part. In normal breathers, the mandible is held in place by atmospheric pressure. When the mouth is closed, one generally swallows, which brings the tongue up against the roof of the mouth and causes it to fill the whole of the oral cavity. As result of the tongue occupying this position, pressure is exerted on the lingual sides of the upper and lower teeth which forces them buccally. In mouth-breathing, the tongue does not exert any force on the upper teeth, which allows the upper arch to remain undeveloped and it is therefore spoken of as a narrow arch. The tongue lies in the lower portion of the oral cavity and does not touch the lower anterior teeth. The mandible drops downward as a result of the loss of atmospheric pressure and the muscles which depress the mandible hold the mandible from developing forward, owing to the weight which they exert on the anterior portion. The mouth being held open, the molars are separated enough to allow the lower molars to lock distal to the upper molars. If mouth-breathing occurs early

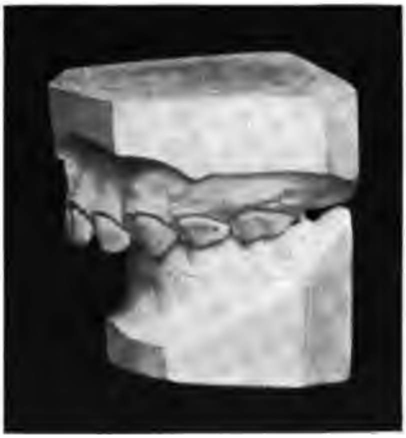

Fig. 78.
Malocclusion of deciduous teeth caused by mouth-breathing.

in life, we find the deciduous teeth as shown in Fig. 78, which makes Class II, Division 1, the prevailing type. If mouth-breathing occurs after the locking of the first molars, and the cusps of the teeth are long, we find such cases as are shown in Fig. 27.

As the action of the muscles is abnormal, the upper lip does not exert pressure on the upper anterior teeth, thus allowing them to protrude. With the open mouth and parted lips, the lower lip drops back against the lower teeth and then the upper portion of the lower lip exerts pressure on the lingual surface of the upper teeth, as shown in Fig. 79. The irritation of the upper teeth causes the lower lip to become thicker, which in turn causes the upper teeth to protrude farther.

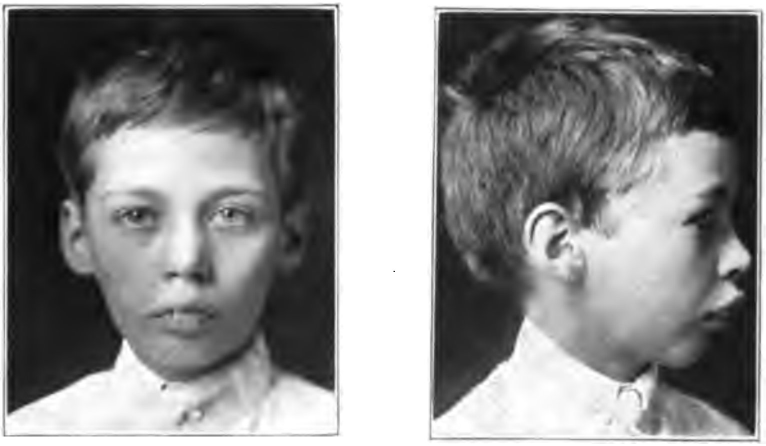

Fig. 79.
Showing abnormal muscular pressure associated with mouth-breathing. (Pollock.)

Enlarged Tonsils.

Associated with the enlargement of the lymphoid tissue in the naso-pharynx is the enlargement of the lymphoid tissue in the oral pharynx, commonly called tonsils.

These masses of tissue are located on the right and left sides of the oral pharynx at the base of the tongue, between the anterior and posterior pillars of the fauces. The tonsils often become inflamed and are the source of much annoyance. Being enclosed in a capsule and containing a considerable amount of connective tissue, the tonsils are quite painful when they become inflamed, in which respect they differ from adenoids. Many times the tonsil becomes chronically inflamed and when in that state often is the beginning of Class III cases. Owing to the inflamed tonsil, the child protrudes the mandible which produces more space between the pillars of the fauces and consequently relieves the pressure on the inflamed tonsil. As a result of the protruded mandible the teeth are locked in an abnormal position. As the muscular action which moved the mandible forward is relinquished, the mandible drops back to its normal position, but the teeth being locked in an abnormal relation remain in that position and malocclusion results.

Habits.

Habits of childhood produce a few types of malocclusion. Thumb and finger sucking has long occupied a place among the etiological factors of malocclusion, but they do not produce as many malocclusions as was formerly supposed. There are a few cases which are produced by lip-biting and lip-sucking, also others which are produced by tongue habits. This type of cases becomes very troublesome to treat unless it is possible to break the patient of the habit.

Sore Teeth.

Very often the decay of a deciduous tooth will cause the child to masticate in such a manner as to miss that tooth with the result that the mandible will be thrown to one side. This will permit some of the teeth to lock abnormally when they are erupting and thus furnish the starting point of a severe malocclusion.

In certain cases other conditions will be found to play a part in the production of malocclusion. Each case must be studied carefully and every effort made to find the etiological factor which has been responsible for the deformity.

CHAPTER V.

ANCHORAGE.

One of the great advantages that renders the fixed appliance more efficient than the removable is the firm attachments which are secured to the moving teeth and to the anchor teeth. This attachment to the anchor teeth is called anchorage.

Anchorage is an attachment to overcome an applied force. In orthodontia the applied force is exerted by the regulating appliance upon the teeth which are in malocclusion and in turn there must be a reaction which must be resisted. As action and reaction are equal, the anchorage must be strong enough to withstand this applied force.

The following outline shows the divisions and subdivisions of the three forms into which anchorage is classified:

- **(A) Intramaxillary**
    - **Simple**
        - **Primary**
        - **Reënforced**
    - **Stationary**
    - **Reciprocal**
        - **Primary**
        - **Compound**
- **(B) Intermaxillary**
    - **Number of teeth removed**
        - **Primary**
        - **Compound**
    - **Manner of teeth movement**
        - **Simple**
        - **Stationary**
        - **Reciprocal**
- **(C) Extramaxillary**
    - **Occipital**
    - **Facial**
    - **Cervical**

Of these various anchorages, intramaxillary is probably the oldest variety that we have. According to the literature on the subject, extramaxillary anchorage was the next form to be used; while intermaxillary anchorage as used today belongs to modern orthodontia.

Intramaxillary Anchorage.—Intramaxillary anchorage is that form of anchorage in which the resistance necessary to overcome the malposed tooth or teeth is derived from a tooth or teeth located in the same arch.

Intramaxillary anchorage is divided into simple, stationary and reciprocal.

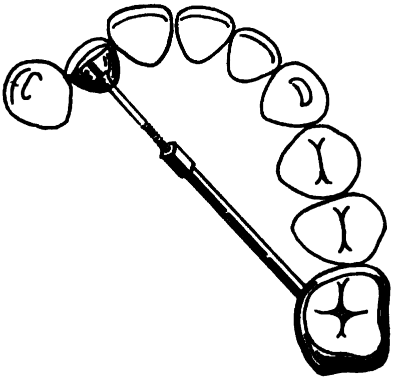

Fig. 80.

Plain bands on lateral and molar teeth with jack-screw, showing simple primary intramaxillary anchorage.

SIMPLE INTRAMAXILLARY ANCHORAGE is subdivided into primary and reënforced, and reciprocal intramaxillary anchorage into primary and compound. Stationary intramaxillary anchorage has no subdivisions, as it is only necessary to use it in that one form.

Simple Primary Intramaxillary Anchorage is that form in which the resistance necessary to overcome the malposed tooth is derived from a larger tooth or one more favorably located. Fig. 80 shows a lateral incisor having force exerted upon it by means of an appliance attached by primary simple intramaxillary anchorage. The molar being the largest tooth and more favorably located, overcomes the force necessary to produce movement of the incisor. No other teeth are employed to overcome the force, nor is the appliance so constructed as to aid the anchor tooth.

Reënforced Simple Intramaxillary Anchorage is that form in which the force necessary to produce movement of the malposed teeth is overcome by two or more teeth, larger or more favorably located. Fig. 81 shows where attachment is made to the molars and premolars to move the premolar on the opposite side.[1]

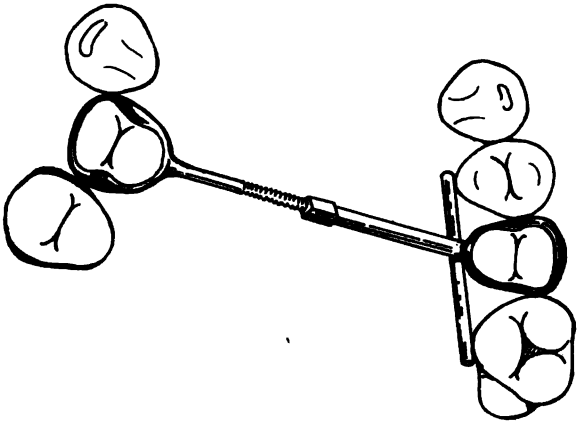

Fig. 81.
Reënforced simple intramaxillary anchorage. Plain bands on premolars, with bar on right premolar band to reënforce it.

In simple anchorage, either primary or reënforced, if sufficient force is brought to bear upon the anchor tooth it will tip as the attachment is made in a hinge manner. If a rubber band is stretched over two separated teeth with the object in view of drawing one toward the other, we would have simple anchorage, providing one tooth is larger and more favorably located. In simple anchorage one of the teeth generally is in normal occlusion and the other in malocclusion, for it is intended to hold the anchor tooth still and move the malposed tooth. Sometimes simple anchorage is secured from the molars which are in normal mesio-distal relation with the idea of moving the anterior teeth mesially, in which case the molars are not disturbed mesio-distally; yet another force may be exerted to move them buccally. The force which moves them buccally does not prevent them from being used as simple anchorage in providing a point from which force is exerted upon the incisors. Therefore several forces may be active on the anchor teeth at one time.

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[1] Reënforced simple intramaxillary anchorage has also been called compound simple intramaxillary anchorage.

One of the disadvantages of simple anchorage is that the appliance cannot be assembled or constructed so as to increase the stability of the anchor tooth. Care must be exercised not to place too much force on the anchor tooth or it will be displaced, much to the chagrin of the operator. The great number of cases in which the anchor tooth was displaced, made it necessary to devise some form of attachment which would be more rigid and fixed. So after many attempts stationary anchorage was evolved and described in its most complete form by Angle.

STATIONARY ANCHORAGE is that form in which the appliance is so constructed and attached to the anchor tooth that if the anchor tooth moves at all, it will move bodily through the process. It has been stated that with the use of simple anchorage there is danger in moving the anchor tooth. There is not one tooth in the mouth which is entirely immovable, as the spring of the alveolar process and the peridental membrane allows the teeth to be moved; so it is logical to expect that a tooth will often move slightly when used as an anchor tooth. If this movement occurs in simple anchorage it is a tipping movement, but in stationary anchorage the "appliance is so attached to the anchor tooth" that a tipping movement is impossible. Not only must the appliance be attached to the anchor tooth in such a manner as to eliminate any "hinge" movement, but all parts of the appliance must be so constructed as to prevent any tipping or springing between the parts. As the early regulating appliances were some form of jack-screw for pushing or traction screw for pulling, the problems of simple and stationary anchorage were worked out with these appliances. Therefore they are featured in the illustrations accompanying this text although being only occasionally used now. Stationary anchorage was developed and perfected as a matter of necessity, for it dates back to the time when extraction played a large part in the regulation of teeth. In Class II, Division 1 cases, it was at one time the approved treatment to extract the upper first premolar and move the canine and incisors distally. Great force was required to move the canine distally and with simple anchorage the molar was displaced. Even reënforced simple anchorage was not sufficient to provide enough resistance to overcome the force necessary to "move" the malposed teeth.

In order to have stationary anchorage, there are two things which must be secured, viz., rigidity and stability of the appliance. The appliance must be made from some material which will not bend under the necessary force, and the parts must be accurately fixed together and attached to the tooth in such a manner as to prohibit any movement between the tooth and the appliance. A molar band is placed on the anchor tooth to which the appliance is rigidly attached. These are the things which make stationary anchorage. Fig. 82 shows the manner in which the traction screw is used with stationary anchorage. The long tube which is soldered to the molar band and in which the traction screw fits accurately, prevents any movement of the parts. The right-angle end of the screw is attached to the canine by engaging the tube which is placed so as to make a hinge joint when the force is placed on the canine. In order for the molar to tip, the canine end of the appliance would have to move gingivally, which could not occur without the canine being depressed in the alveolus.

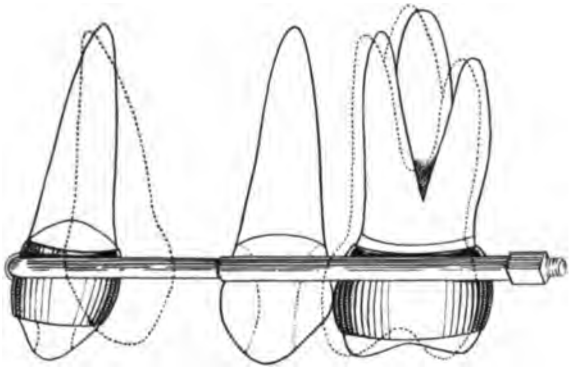

Fig. 82.

Showing plain band on canine and clamp band on molar. The long tube on molar band prevents molar from tipping, hence if it moves it must move bodily, as shown by the dotted outline. The canine will tip.

Reciprocal Anchorage is that form in which the force necessary to move a malposed tooth is derived from another malposed tooth, with the idea that both be made to assume a proper position in the line of occlusion. Fig. 83 shows two canines in lingual occlusion. A jack-screw placed between them would exert pressure in such a manner as to move both of them buccally. One of the canines may move more easily than the other, in which case some other means must be employed to increase the resistance of the easily moving tooth. These things will be mentioned later. A rubber band placed around the central incisors which are separated gives us reciprocal anchorage. Reciprocal anchorage is divided into primary and compound. It can also be divided into simple and stationary.

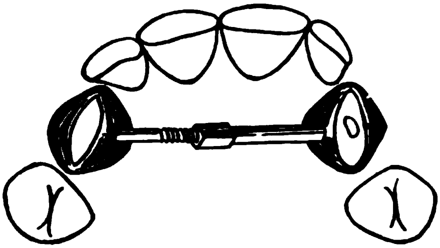

Fig. 83.
Primary reciprocal intramaxillary anchorage.

Primary Reciprocal Intramaxillary Anchorage is that form in which the appliance is attached to but one malposed tooth on each side with the object in view of moving only those teeth to which the appliance is attached (Fig. 83). A wire passed around the teeth, as shown in Fig. 84, is primary reciprocal anchorage.

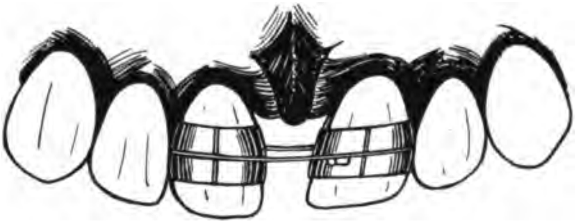

Fig. 84.
Another form of primary reciprocal anchorage. The centrals will be the teeth to move.

Compound Reciprocal Intramaxillary Anchorage is that form in which the appliance is so constructed that other teeth are moved besides the one to which the appliance is attached. Fig. 85 shows a jack-screw attached to a band on the second premolar with a lingual bar soldered to the band resting against the molar, premolar and canine which will move the teeth on each side buccally. The appliance used is exactly the same as shown in Fig. 83, yet several teeth are being moved when only two were moved with primary reciprocal intramaxillary

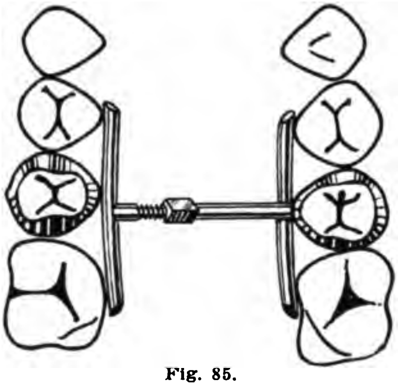

Fig. 85.
Compound reciprocal intramaxillary anchorage.

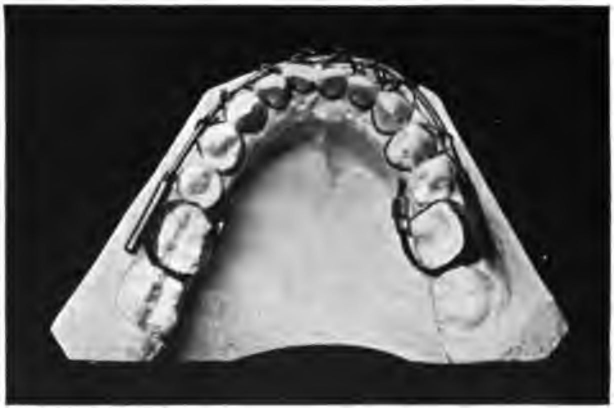

Fig. 86.
The use of the expansion arch generally embodies compound reciprocal intramaxillary anchorage.

anchorage. The author has used the same appliance in most of the anchorages described to show that anchorage does not depend upon certain appliances. Different appliances can be constructed and used with these anchorages to meet the requirements of the cases.

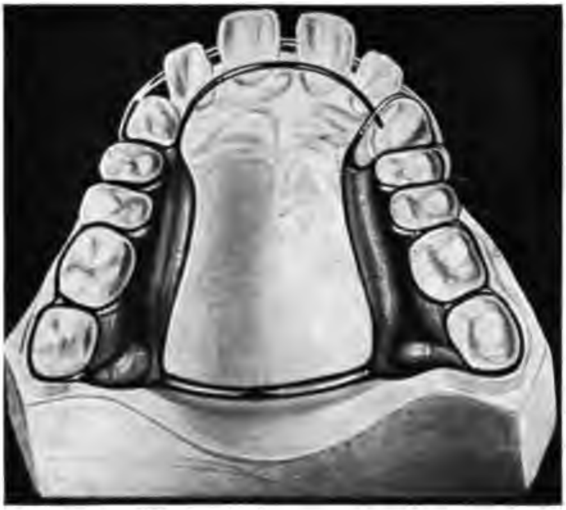

Fig. 87-A.

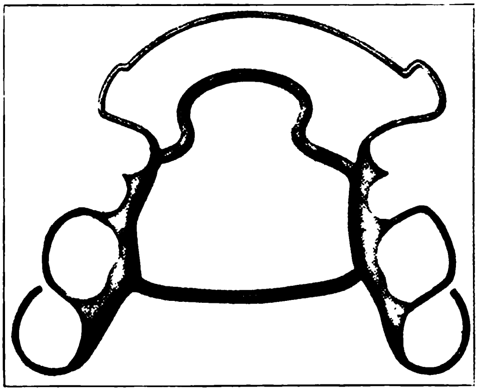

Fig. 87-B.
Removable appliances employing compound reciprocal intramaxillary anchorage. (Courtesy B. I. S. Co.)

Compound reciprocal intramaxillary anchorage is the form employed when the expansion arch is used, as shown in Fig. 86. It is also the anchorage employed in the use of the removable appliance shown in Fig. 87. In fact, it is used in nearly all cases of malocclusion. To be exact, the use of the expansion arch as shown in Fig. 86 evolves simple compound reciprocal intramaxillary anchorage.

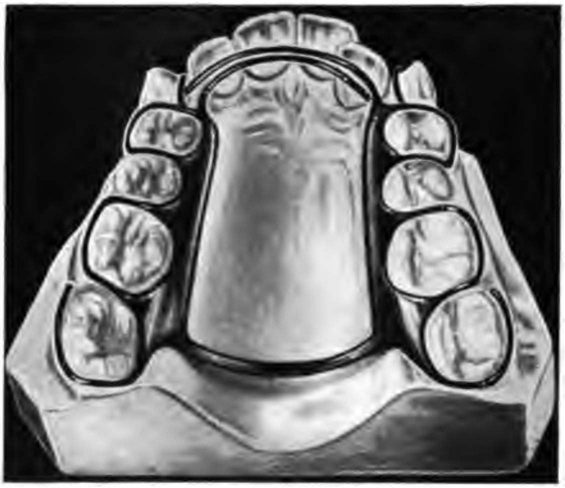

Fig. 87-C.

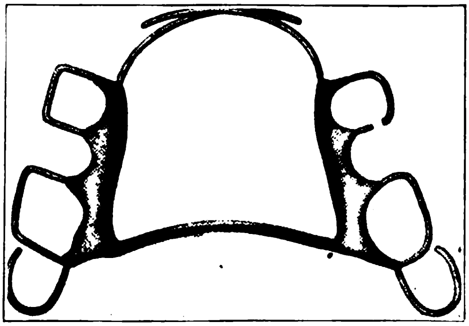

Fig. 87-D.
Removable appliance employing compound reciprocal intramaxillary anchorage. (Courtesy B. I. S. Co.)

Reciprocal anchorage is further divided into simple reciprocal and stationary reciprocal.

Simple Reciprocal Intramaxillary Anchorage, either primary or compound, is where the attachment is made to the anchor tooth in such a manner that the teeth can tip. Fig. 88 shows an expansion arch or spring attached to two canines with the object in view of moving them buccally. The tubes are so placed that the teeth will tip because there is a hinge motion possible between the arch and the tube on the band.

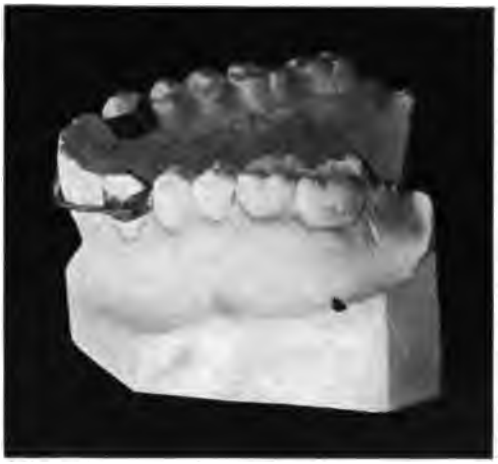

Fig. 88.
Simple reciprocal intramaxillary anchorage which allows anchor teeth to tip.

Stationary Reciprocal Intramaxillary Anchorage, either primary or compound, is that form in which the appliance is attached to the anchor teeth in such a manner that they will be moved bodily through the process. Fig. 89 illustrates the same small expansion arch as shown in Fig. 88, which is again attached to two canines, but the tube is so placed on the bands and the end of the arch bent in such a way that the canines are moved bodily. In cases where the molars are to be moved bodily an arch with a square end and a tube which is square

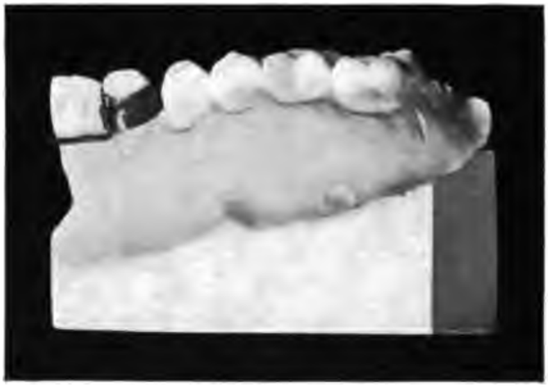

Fig. 89-A.

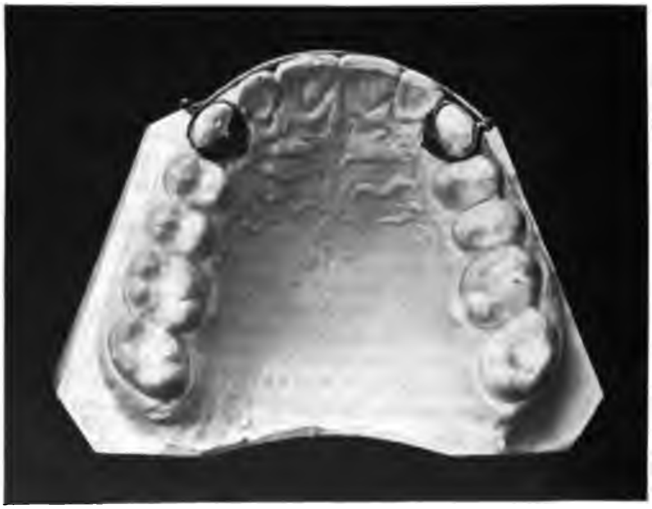

Fig. 89-B.
Stationary reciprocal intramaxillary anchorage. Anchor teeth must move bodily.

on the inside make stationary reciprocal anchorage on the molars with the expansion arch (Fig. 90).

The use of the ordinary expansion arch with round ends and the wire ligatures embodies simple compound reciprocal intramaxillary anchorage. This is the most universally used form of anchorage.

Intermaxillary Anchorage.—Intermaxillary anchorage has been defined as that form in which the resistance necessary to overcome the malposed tooth or teeth is derived from a tooth or teeth located in the opposite arch. In other words, the malposed tooth and the anchorage are in different arches. Intermaxillary anchorage is the newest form that we have and has done more to eliminate the extraction of teeth than any other. It offers many combinations and is the least understood by the majority of practitioners of any of the anchorages.

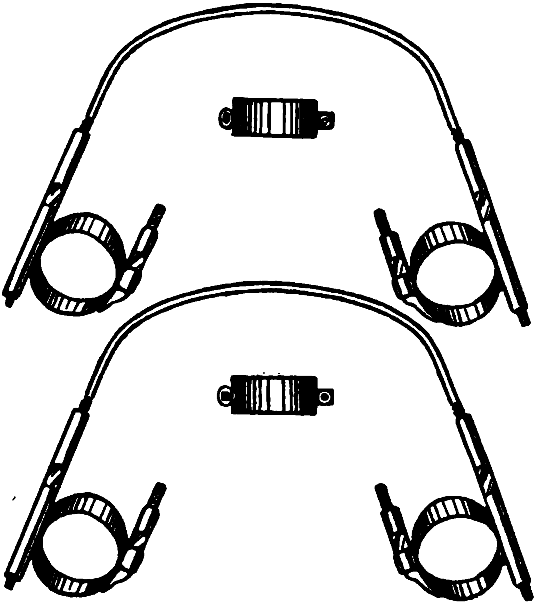

Fig. 90.

The square tube and arch used on molars make stationary anchorage on the molars. Oval buccal tube shown above, square buccal tube below.

In regard to the number of teeth moved, intermaxillary anchorage is divided into primary and compound, and in regard to the manner of movement into simple, stationary and reciprocal.

Primary Simple Intermaxillary Anchorage is employed when a tooth in one arch is used to overcome the force necessary to move a tooth in the opposite arch. It is employed in moving teeth which are in infra-occlusion. An example is shown in Fig. 91, where the canine is in infra-occlusion and the anchorage obtained from the lower premolar.

Compound Simple Intermaxillary Anchorage is that form in which two or more teeth in one arch are moved by force derived from teeth in the opposite arch. This is shown in Fig. 92, in which case the central incisors are in infra-occlusion and the force is derived from the lower teeth.

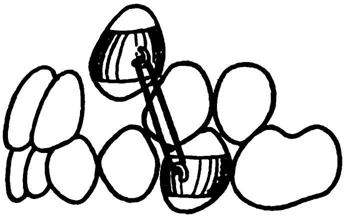

Fig. 91.

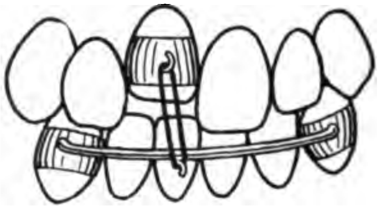

Fig. 92.

Fig. 91.—Primary simple intermaxillary anchorage.
Fig. 92.—Compound simple intermaxillary anchorage.

Primary Reciprocal Intermaxillary Anchorage is that form in which the force necessary to move a malposed tooth in one arch is derived from a malposed tooth in the opposite arch, the force causing both to assume a proper position in the line of occlusion. An upper and lower canine which are in infra-occlusion, as shown in Fig. 93, is an example of this anchorage. Such cases as illustrated here are seldom seen as there is generally some other malocclusion present demanding treatment at the same time.

Compound Reciprocal Intermaxillary Anchorage is that form in which two or more malposed teeth of one arch are pitted against two or more teeth in the opposite arch for the purpose of causing both to assume a proper position in the line of occlusion. This form of anchorage should be used when the six anterior teeth of the upper and lower arch are in infra-occlusion, as illustrated in Fig. 94. However, it is very seldom that we find such conditions that demand an equal movement of the upper and lower anterior teeth. The most frequent use of compound reciprocal intermaxillary anchorage is in the treatment of Class II and III cases, and according to the early literature on the subject, this was the manner in which it was employed. It also appears to have been used in this way by Baker and later called "Baker Anchorage" by Angle. When all of the teeth in one arch are pitted against all of the teeth in the opposing arch, with the object in view of moving the teeth in both arches, this form of anchorage is the one usually

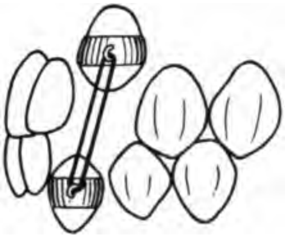

Fig. 93.

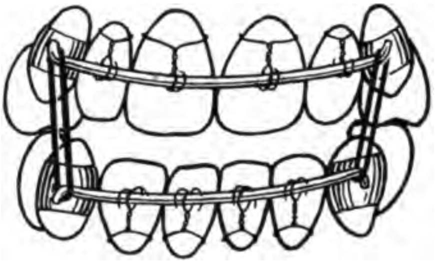

Fig. 94.

Fig. 93.—Primary reciprocal intermaxillary anchorage.
Fig. 94.—Compound reciprocal intermaxillary anchorage.

employed, as shown in Fig. 95. It is possible to use compound reciprocal intermaxillary anchorage by pitting a

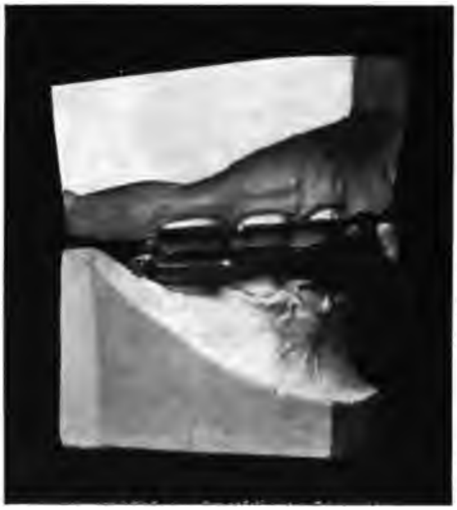

Fig. 95-A.

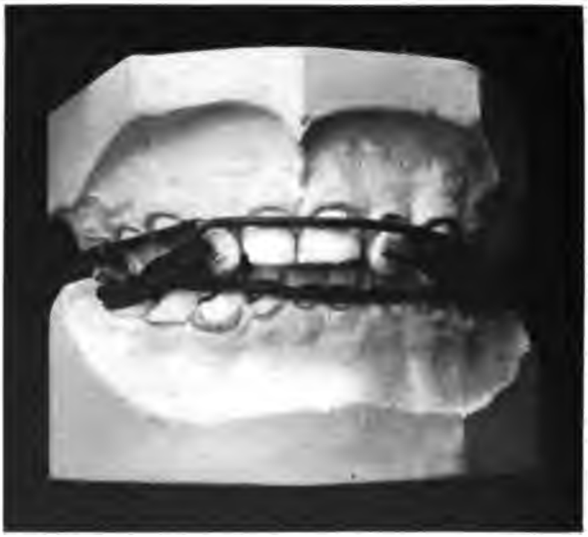

Fig. 95-B.
Compound reciprocal intermaxillary anchorage used with expansion arches.

certain number of the teeth in one arch against a certain number of teeth in the opposing arch. This does not mean that the same kind of teeth in one arch are pitted against the same kind of teeth in the other. In Fig. 96 is shown a case in which it was necessary to move the superior incisors distally and the lower premolars, canines and incisors mesially. This was accomplished by using compound reciprocal intermaxillary anchorage, the application of which is described in Chapter IX. This form of intermaxillary anchorage should also be called simple, the teeth being attached in such a manner as to permit tipping.

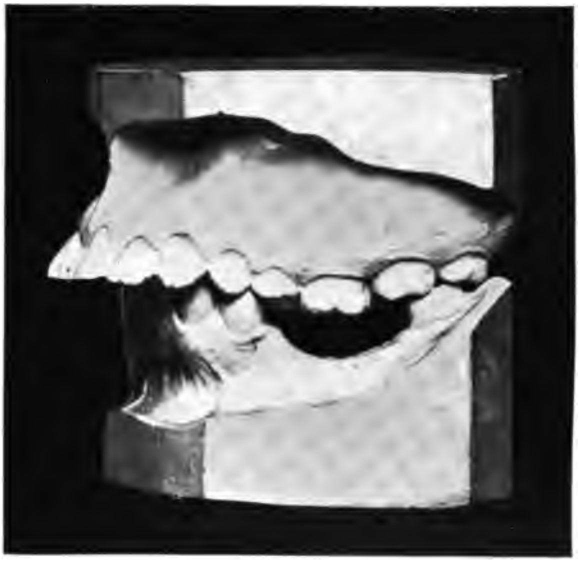

Fig. 96.
An ideal case for the use of compound reciprocal intermaxillary anchorage.

Stationary Intermaxillary Anchorage is that form in which the attachment is made to the anchor teeth in one arch in such a manner that if they move at all they must be dragged bodily through the process, the anchor teeth and the moving teeth being in different arches. This form of anchorage is obtained by constructing and applying the appliance in such a manner as to make tipping impossible and is the outgrowth of simple compound reciprocal intermaxillary anchorage. It was found in the treatment of certain cases that the lower teeth moved forward more rapidly than the upper teeth moved distally. In order to stop the movement of the lower teeth it becomes necessary to make them stationary, which was done by the proper construction and attachment of the appliance. This greatly increased the movement of the upper teeth, while the lower teeth remained immovable. If bands are placed on the upper and lower molars and the arches applied with intermaxillary rubbers as shown in Fig. 95, we would have compound reciprocal intermaxillary anchorage of the simple form. This form of anchorage would permit a tipping of the upper and lower teeth which would make it simple anchorage. As stated before, the upper teeth would not move as rap-

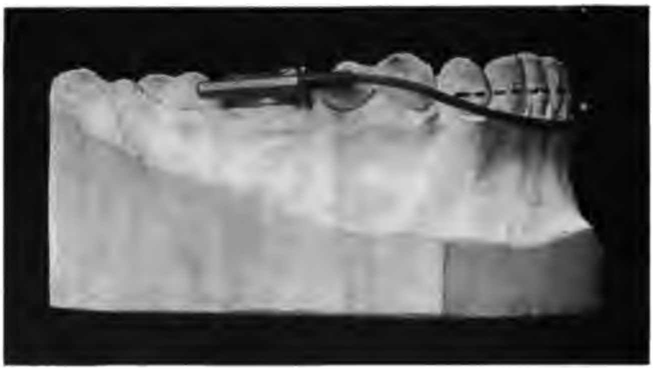

Fig. 97.

Showing manner of bending lower arch down and then springing upward to make lower molars stationary. Dotted line indicates position that lower arch will occupy when sprung upward.

idly as the lower and by bending the anterior part of the lower arch gingivally, also placing wires around the anterior lower teeth, which would spring the arch upward to its proper position, a backward force would be exerted upon the lower molar which would overcome the forward pull of the intermaxillary rubbers. The tipping stress exerted upon the lower molars by the bent arch and the wires on the lower anterior teeth springing the anterior portion upward, converts the anchorage into a stationary one on the lower teeth. The upper teeth can still tip. The manner of bending the arch and wiring it is shown in Fig. 97.

As soon as the lower appliance is adjusted, as shown in Fig. 97, the anchorage is no longer reciprocal as the lower molars stop tipping. By making the attachment on the lower arch, as shown in Fig. 123, the lower anterior teeth are also prevented from tipping and must move bodily. This forms stationary attachment to the lower teeth.

It is very seldom that the teeth of both arches are moved bodily to the same extent. What generally occurs is that the teeth of one arch are made rigid by the attachment of the appliance so as to prevent movement and the teeth of the other arch are so attached to the appliance that they will move bodily. This would then only be another form of compound stationary intermaxillary anchorage. An example of the stationary attachment of teeth in both arches is seen in Fig. 216-B, which is a Class II, Division 1 case. It has been found that the best results in these cases are obtained by not moving the upper molars and canines distally and moving the entire lower arch or teeth mesially the entire distance necessary to establish normal occlusion. Also, the best facial results and masticating apparatus are obtained by moving the lower teeth bodily. Bands are placed on the upper and lower molars. The upper arch is ligated to all of the upper teeth in such a manner as to prevent the upper molars from tipping. If the anterior portion of the upper expansion arch cannot move occlusally the molars cannot tip. The lower expansion arch is also wired to the lower teeth so as to prevent tipping of the molars; to prevent tipping of the incisors, spurs are placed on the lower arch and the incisors wired to them in such a manner as to hold the teeth perpendicular with the spurs, as shown in Fig. 123. The advantage of stationary compound intermaxillary anchorage whether used reciprocally or not is very great and is the last form of intermaxillary anchorage to be introduced.

Extramaxillary Anchorage.—Extramaxillary anchorage is that form in which the resistance necessary to overcome the malposed tooth or teeth is derived from some source outside the oral cavity. It offers the most immovable base that can be obtained. The principal objection is the appearance of the appliance. There are three types of extramaxillary anchorage—occipital, facial and cervical.

Occipital Anchorage is where the force necessary to overcome the malposed tooth is derived from the occipital region. This is one of the oldest forms of anchorage that we have record of. It was first used with an ordinary night-cap and was improved and modified by various means until we find the most ideal form as designed by Angle.

Facial Anchorage is where force necessary to overcome the malposed teeth is derived from the facial bones. This anchorage was introduced by V. E. Barnes and consists of a device which rests against the malar bones and forehead.

Cervical Anchorage was introduced and first applied by Carl Case and is that form in which the force necessary to overcome the malposed teeth is derived from the

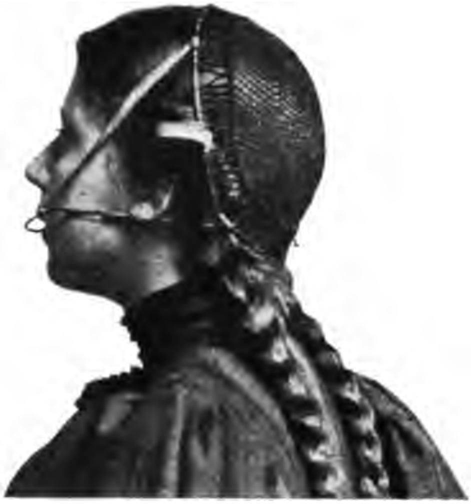

Fig. 98.
Occipital extramaxillary anchorage. (After Angle.)

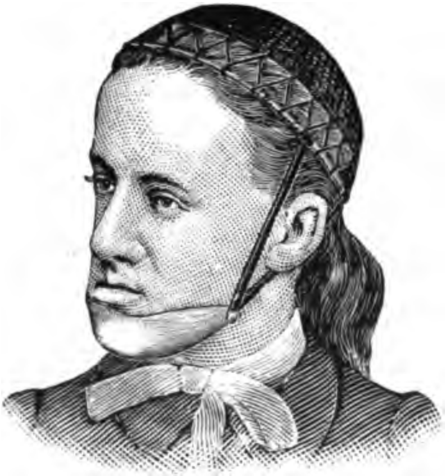

Fig. 99.
Occipital extramaxillary anchorage. (After Angle.)

cervical vertebræ. Occipital anchorage was used in those cases which demanded a distal movement of the anterior teeth. It was used on the superior anterior teeth as shown by Fig. 98, and by means of the chin cap (Fig. 99) the pressure was exerted on the mandible. It was also used to exert pressure on the lower anterior teeth, but there was a tendency to elongate the lower anterior teeth. It was to overcome this tendency to elongate the lower anterior teeth that cervical anchorage was devised. Facial anchorage was devised to move the teeth mesially, and was supposed to be valuable in those cases which demanded the forward movement of the upper and lower molars. If one is able to use the various other anchorages as they should be used, there is little need for extramaxillary anchorage.

Owing to the fact that reciprocal anchorage utilizes all of the force exerted on the malposed teeth, it is the most useful form of anchorage. With intermaxillary anchorage in the various compound reciprocal and stationary forms, we are able to get tooth movement in any particular direction desired. Simple anchorage is the easiest to obtain but not always sufficient for the needs of the case. Stationary anchorage requires a greater understanding of mechanics than any other form. The principal and most useful forms of anchorage will be considered in the chapter on treatment of cases.

CHAPTER VI.

REGULATING APPLIANCES.

Principles of Regulating Appliances.

Regulating appliances are mechanical devices for the purpose of exerting force upon malposed teeth, in turn creating cell activity and thereby causing the teeth to assume a proper position in the line of occlusion. It is necessary that the operator have a proper conception of what the regulating appliance is for. The appliance must be viewed from three distinct angles. First, it is a mechanical device for exerting force upon malposed teeth, which is the necessary feature. If the appliance is mechanically imperfect and does not exert the pressure upon the proper teeth, failure will result. The second and equally important point is the purpose of the appliance, which is to exert force upon the malposed teeth to ''create cell activity,'' after which, if the cell activity occurs, the teeth, as a result of the force of the appliance and the cell activity, assume a proper position in the dental arch. The mere exertion of force upon the teeth is not enough to cause them to assume the position in the line of occlusion which was intended they should occupy. It is true that teeth have been moved and can be moved by the application of a great amount of force and such movement occurs too often, but the movement is not physiological and those who use such methods are not practicing orthodontia. They are only moving teeth and causing much suffering to their patients.

Requirements of Regulating Appliances.

In the definition of appliances, we state what the appliance is for and what it must do, which are the essential features of any appliance. However, there are requirements which appliances must possess and some appliances are better suited to do certain things and correct certain types of malocclusion than others.

Efficiency.—Efficiency might be named as the first essential feature, which means that the appliance should do the work for which it was devised. This may seem like an extravagant statement yet formerly appliances have been invented which were not suited to do the work intended. It is possible to exert force on teeth with very crude and unscientific devices and accomplish some results. However, when we speak of efficiency, we mean that the appliance should accomplish the desired results without waste of time or energy. The appliance should be so made that it will follow certain mechanical principles which have been proven effective in other devices. There must be some means of attaching the appliance to the teeth to be moved so that it will be possible to exert the required amount of force and in the proper direction. The appliance must be attached to some point which is known as the anchor tooth, or we may say that the appliance must possess sufficient anchorage. As anchorage is one of the essential features in the efficiency of appliances, it has been described under a separate heading.

Durability.—The appliance must be so constructed that it will be capable of use during the entire operation. It should be of such material that it will be little affected by the fluids of the mouth, and of such design that force can be exerted upon any or all of the teeth at the same or in opposite directions. By having such an appliance it is not necessary to subject the patient to the fitting of several different appliances before the case is completed. It saves much time for the operator and accomplishes the result in the shortest possible time.

Cleanliness and Antisepsis are properties which go together to a certain extent. It must be possible for the patient to keep the teeth clean which can only be accomplished when the appliance is constructed with that idea in view. For example, round appliances are more easily cleaned than flat appliances would be, for there is not so much of the appliance in contact with the teeth. All bands must be cemented on to prevent anything getting between the teeth and the bands. The use of cement is for prophylactic measures. In regard to aseptic appliances, the material out of which the appliances are constructed plays an important part. Some alloy which contains an amount of copper or zinc is more aseptic than gold or platinum. The use of some of the noncorrosive alloys offers the advantage of being aseptic and at the same time making a good appearance in the mouth.

Simplicity is another characteristic which must always be considered. All mechanical devices are more useful as they approach simplicity. In fact the only perfect mechanical devices we have are those which have eliminated all superfluous parts until nothing remains which does not perform some definite function. The tendency in modern regulating appliances is to eliminate all parts which do not add greatly to the value of the appliance. Appliances should be constructed so as to get the greatest number of principles without increasing the bulk. Many devices constructed in former years have failed because simplicity was neglected.

Inconspicuousness is a feature which is considered only for the satisfaction of the patient. This essential is one which the patient is always considering and often the success of the practitioner will depend upon his ability to make the appliance inconspicuous. If cleanliness, aseptic properties and simplicity have been considered as they should be, inconspicuousness will generally follow. Still, many appliances which are conspicuous in the hands of some operators look well and are little seen when used by others. Experience has shown that the expansion arch, which is the most universal fixed appliance, can be made inconspicuous if properly applied and at the same time will be just as efficient as if it were used otherwise. In no case must efficiency be sacrificed for inconspicuousness, as we are often requested to do by the patient asking that the appliance be placed lingual to the teeth. Experience has proven that a lingual appliance is less effective than one on the labial side of the teeth, and the tongue is more sensitive to objects than are the lips and cheeks.

Fixed and Removable Appliances.

Regulating appliances are divided into fixed and removable. Fixed appliances are those which are placed on the teeth in such a manner that they can only be removed by the operator. Removable appliances are those which are attached to the teeth in such a manner that they can be removed by the patient.

Fixed Appliances have the advantage of firm attachment both to the moving teeth and to the anchor teeth. Being firmly attached, the appliance can be of smaller size than if of the removable variety. It is not as inconspicuous or as cleanly as the removable type.

Removable Appliances are recommended because of the fact that they can be removed by the patient and the appliance and teeth thoroughly cleaned after each meal. They are less conspicuous than the fixed appliances, but have the disadvantage of not being securely attached to the moving teeth or to the anchor teeth which limits their use in some of the complicated cases of malocclusion. The simpler forms of malocclusion can be treated with the removable appliance, but there are a large number of cases in which the results obtained by the fixed appliance are better than the author has ever seen from the treatment of similar cases by the removable appliance. One of the great advantages of the removable appliance, namely, that the patient can remove it, becomes a disadvantage in the mouths of some patients. From observation on the use of the fixed and removable appliances, the author is of the opinion that better results can be obtained from the former than from the latter.

Technique for Making Regulating Appliances.

We have already stated that appliances are divided into fixed and removable and have mentioned the various advantages which each possesses. Believing that the best results are obtained by the proper use of the fixed appliances, the various parts will be described here.

Various forms of fixed devices have been placed on the market and used at different times, some of which have become obsolete. It is the author's intention to consider only those which have a place in modern orthodontia, those that he has found of advantage and which are employed in ninety per cent of all of the malocclusions treated by men who are devoting their entire time to the practice of orthodontia.

Bands.

Consistent with the various anchorages already described, bands form one of the principal parts of the fixed appliance. Bands are divided into plain and clamp (Figs. 100, 109). A plain band is made by pinching or burnishing a piece of metal around the tooth to be banded or around a model of the same and soldering the ends together. The size of the band is not adjustable. They are made and used on all of the teeth, but the best fitting bands are made on the six anterior teeth.

Which form of plain band was first used or the inventor of same has never been known. They did not meet with universal use until the introduction of cement. The use and making of the plain band as employed today was introduced by Magill, of Erie, Pa., and is known in literature as the "Magill band."

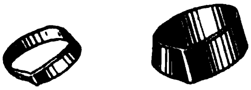

Fig. 100.
Plain or Magill bands.

Composition of Appliances.—The band may be made out of various materials, namely, gold, gold and platinum, iridio-platinum, German or nickel silver, and aluminum-bronze. There are several alloys on the market sold under various names which are said to possess certain desirable qualities. These alloys are probably aluminum-bronze. The "non-corrosive material" sold by some manufacturers makes a very desirable material. Each one of the various materials used for plain bands has its advantages and disadvantages.

Gold, which was probably used first, is recommended for its ease of manipulation and color. It does not tarnish easily in the mouth, although in some instances it does discolor greatly. One of the disadvantages of gold is the lack of strength when rolled thin enough to permit its use without causing great separation of the teeth. Also, if appliances are attached to gold bands and considerable force exerted upon the appliances the gold will tear. Still the greatest disadvantage to the use of gold is that it possesses no antiseptic property. Alloys of gold to form what is known as clasp metal have been used which eliminate some of the first objections, but the last one still remains. Gold and platinum material, composed of equal parts of gold and platinum, makes an alloy which is strong, can be rolled thin and has a nice appearance, discolors in some mouths, and is not antiseptic; that is, does not retard the growth of microörganisms. On account of the last named objection it is little used by the author.

Iridio-platinum is a material much used by some practitioners, and is very strong even when rolled thin. It is seldom necessary to use it more than .005 or 36 gauge and in some cases will possess sufficient strength when used .003 or 40 gauge. It melts at a high degree of temperature and can be soldered with pure gold. This leaves little danger of the solder-joint opening when other solder attachments are being made to the band. Also, the joint will not open under stress as sometimes happens when a low karat solder is used. Iridio-platinum discolors in some mouths and like the other noble metals does not retard the growth of microörganisms. A tooth which is in contact with an iridio-platinum appliance is very liable to decay; in fact it seems as if the tooth is more apt to decay than not to. As a result of the use of this material, many caries have been caused which would not have been produced otherwise.

German or nickel silver has been used in the past in the making of appliances to a greater extent than any other material. Various metals are used in the alloying of the material, generally some percentage of nickel, copper, tin or zinc being employed, each manufacturer having his own combinations. The great advantage of German silver lies in its strength, being much stronger than gold, and even when rolled thin and made pliable by annealing, it will not stretch. It can be soldered with a high karat solder, the melting point being higher than low karat golds. It takes a high polish and in some mouths holds the color well. German silver can be easily gold-plated, but in those mouths where discoloration occurs the plate does not last long. It always corrodes and is affected by the fluids of the mouth. Pits will form in the bands and in some cases after six months to a year deep pits will form, which finally perforate the band. This limits the time during which a German silver band can be left in the mouths of some patients. In spite of all these objections German silver has an advantage which is not possessed by the metals above mentioned, namely, its antiseptic properties. This metal will discolor and the teeth become black, but there is less liability of decay occurring than if the appliance was not there. The author much prefers, to a metal which invites caries, one that discolors but which can be kept clean with a reasonable amount of care, and one which retards the growth of microörganisms and decay.

The objectionable characteristic of German silver—its tendency to discolor—was taken up by a number of manufacturers with the result that several metals were placed on the market which probably should be called aluminum-bronze. The author has never employed aluminum-bronze under that name, but for the past two years has used the non-corrosive metal as sold by the various dealers, and he finds that it has all of the advantages of German silver; is germicidal, easy to work, can be made extremely pliable but is slightly more difficult to solder. The metal is more yellow than German silver and in some mouths turns the color of gold. It will discolor to no greater extent than gold, gold and platinum or iridio-platinum. In some mouths the bands have a tendency to pit, but this is a slight objection which is more than offset by the germicidal action.

Most of the materials above mentioned can be bought in any suitable width and thickness. Gauge 36 or .005 is the most ideal thickness for all purposes. For the molar bands a thicker gauge may be used and for the anterior teeth one that is thinner may be employed.

Whatever material is employed must be well annealed before being used. The author prefers to make the band directly over the tooth, as a closer fit can be obtained and much time saved than if a model of the tooth is made and the band then made over the model.

Band Technique.—The seam of the band which is the soldered joint, can be placed on the lingual or labial side of the teeth. This is decided by the occlusion of the teeth and what other attachments are to be placed on the band. It is more convenient to make the seam on the labial side and unless there is some very good reason for not doing so, that side is always chosen.

In making a band for the upper incisor, it is seldom necessary to separate the teeth previous to making the band. By using a 38 gauge material it can generally be passed between the teeth. A piece of band material slightly longer than is needed for the band is passed between the teeth and the lingual portion is burnished close to the tooth. Traction is made on the free ends of the band material and while this is being done the labial portion is made to conform to the teeth by

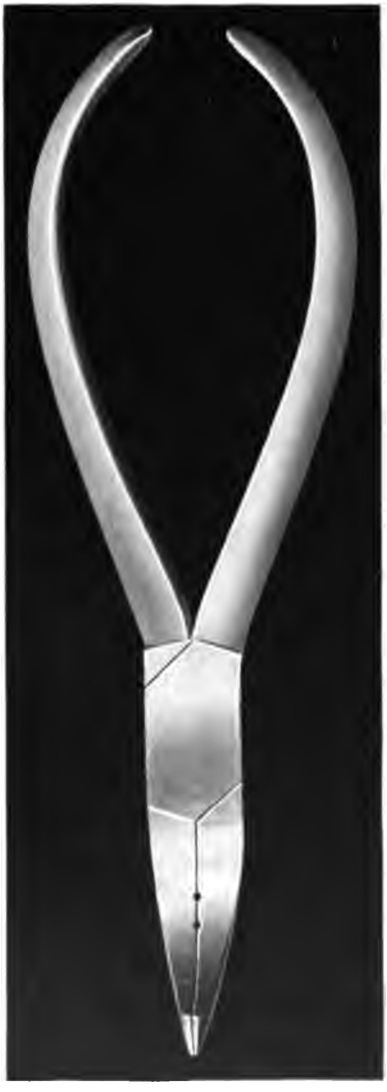

Fig. 101.—Angle's band-forming pliers.

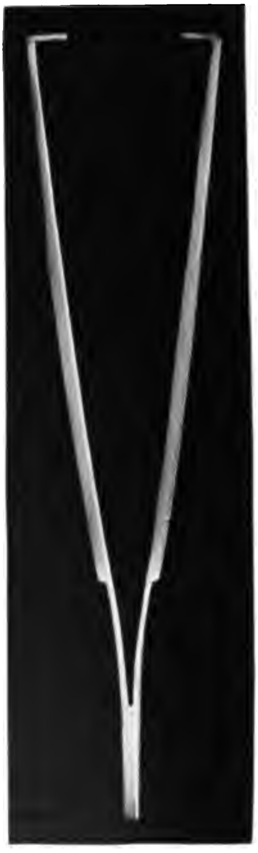

Fig. 102.—Angle's soldering pliers.

pinching it close to the teeth with a pair of pliers which have beaks, the edges of which come close together. For that purpose there are several forms of pliers on the market known as band-forming pliers. The author finds those designed by Angle, and shown in Fig. 101, best suited for his use. After the band has been pinched so as to conform close to the teeth at all points, it is soldered by holding the material with a pair of soldering pliers, made of some material which conducts heat poorly, and the points are bent at right angles (Fig. 102) so as to conduct little heat away from the band. A little flux is placed on the inside of the seam (or joint) and when heated to the proper degree, a piece of solder in wire form is touched to the seam. The use of a solder, either silver or gold, in wire form will be found to be a great convenience and is used as shown in Fig. 103. In making these bands it is necessary to have a blowpipe

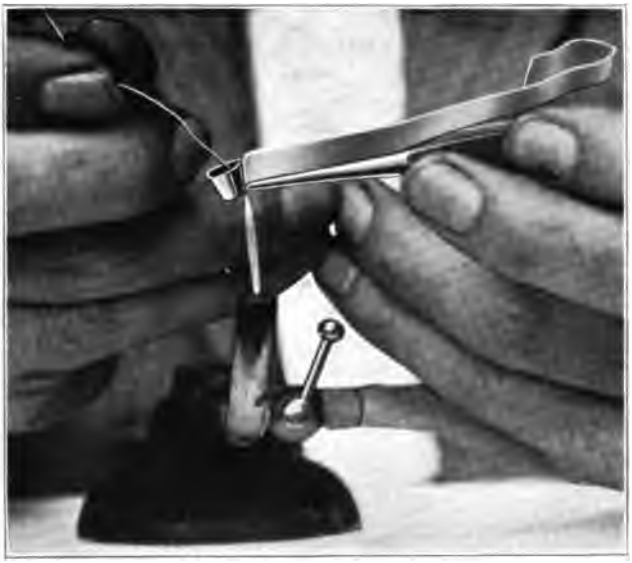

Fig. 103.
Using solder in wire form.

which can be at all times under the absolute control of the operator and still leave both hands free. After giving every blowpipe and method a fair trial the author has reached the conclusion that the best results can be secured with the Herpath or Lane pipe, the air supply coming from the mouth blowpipe. There is no objection to compressed air, but the author has secured better control over his flame in the "old-fashioned way."

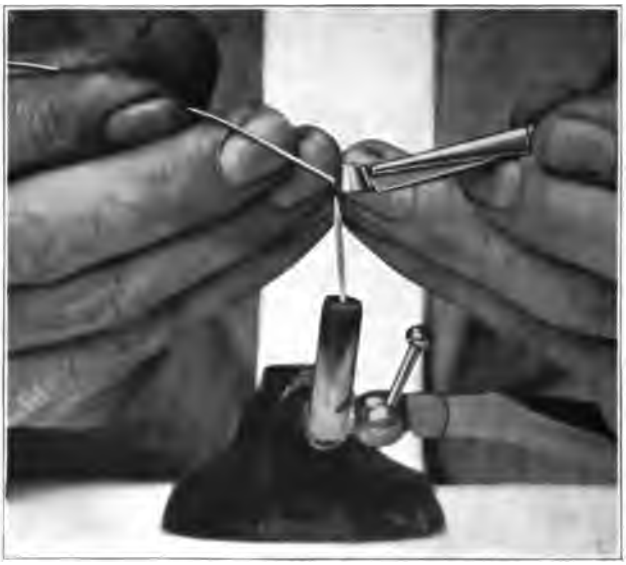

Fig. 104.
Manner of holding wire to make spur on plain band.

Plain bands on the incisors should be placed as far gingivally as possible without infringing upon the gums. As a rule the author does not festoon the band, but leaves it the same width the entire circumference, as it makes a stronger band. Any band is only as strong as its weakest point. Some orthodontists trim the band so that it follows the gum line on all sides of the tooth. Others trim it on the approximal side so that it will not interfere with the approximal contact, which makes a neat but very weak band. Various attachments are placed on the bands for various purposes.

Soldering Technique.—A small spur is soldered on the band for rotating teeth and is made as follows:

The spur should be attached at a point far enough gingivally so that the ligature will pass below the gum and above the approximal contact point, and slightly to the side toward which the tooth is to be rotated. A piece of wire of 18 or 20 gauge is selected and the end filed to an angle of 45 degrees. The band is held in the pliers and the solder flowed at the point to which the spur is to be attached. This is done by heating the band and touching it with the wire-solder when it reaches the proper heat. A little flux is placed on the wire and then by holding the piece as shown in Fig. 104 the wire is soldered

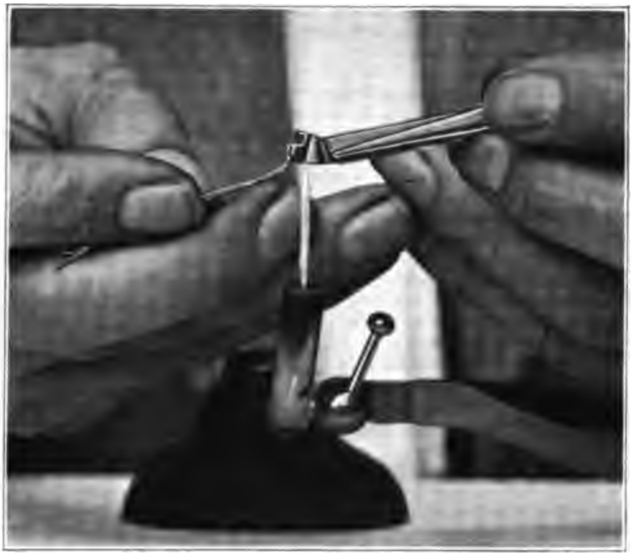

Fig. 105.
Manner of holding small tube on ligature wire while soldering same to band.

to the band. The wire is then cut off making a spur about one and a half times as long as the thickness of the ligature-wire, or ligature that is to be used. In place of the spur Brady has suggested the use of small tubes soldered well toward the gingival portion of the band, through which the ligature is passed. When threaded through the tube the ligature will be prevented from coming off should it in any way become loose on account of the teeth moving a great deal between visits. Care must be taken in soldering the tube to the band to prevent the solder from flowing into the tube and closing it. It is held and soldered to the band as shown in Fig. 105. The plain band is also used with the perpendicular tube as employed in the bodily movement of teeth as suggested by Angle. In those cases the seam of the band is generally made on the lingual side as a matter of convenience.

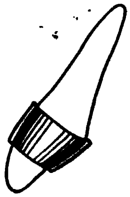

Fig. 106.
Band pinched on lingual and labial sides.

The making of the canine band is more difficult owing to the pointed shape of the teeth. A piece of the band material is placed between the teeth and traction made on the material. It will be seen that the occlusal portion of the material on the lingual side stands away from the tooth. While traction is being made on the ends of the band material the lingual portion of the material is pinched with the band-forming pliers, making a pinch as shown in Fig. 106. The material is then removed from the tooth and flux applied to the lingual portion of the pinched band material and heat applied and touched with the solder at the proper time. It will now be found that the lingual portion of the material fits the canine accurately. The pinch is next made on the labial side as was done with the incisors, and soldered in the same way.

In making plain bands for the premolars and molars, it is best to slightly separate those teeth, which enables us to get the material between the teeth more easily and also to secure a better fit, which is greatly to be desired, for it will require long experience before one is able to make a plain band on the molars and premolars that will in any manner near approach the neatness of the anterior bands. The best means of producing separation is to take a piece of ligature wire of about 26 gauge and pass it between the teeth gingivally to the approximal contact point and bring the end occlusally to the contact point and twist the ends together. The twisting of the ends exerts pressure upon the teeth and slightly separates them. One of these wires should be placed on the mesial and distal side of the tooth to be banded. Some have suggested the tieing of silk ligature or traction cable in the same manner as the wire ligature is placed, but the author does not like it as well for it becomes filthy and often makes the approximal gum tissue sore. The wire ligature will produce sufficient space in twenty-four hours but no harm will result if left a longer time. In making a band for a molar or premolar, the material is passed around the tooth and the pinch is made at the mesio-buccal angle so as to bring the seam as near the approximal contact as possible. This places the soldered portion of the band out of the way of the cheek.

As the gingival portion of the permanent molars and premolars is of a smaller diameter than at the contact points, care must be exercised not to pinch the band too tight at the gingival portion or it will be impossible to get the band on the tooth after it is soldered. After the band is soldered it is then placed on the tooth and if made for the premolar, the mesial and distal occlusal margins are burnished into the mesial and distal portions of the central fossa. If made for a molar, the disto-occlusal portion is burnished into the distal part of the central fossa of the lower molars and into the distal portion of the disto-lingual fossa of the upper molars. This prevents the band from being forced too far gingivally, should the cement become loosened between visits. It will generally be necessary to make a pinch on the linguo-occlusal margin of the upper molars so that the band will fit the convexity of the lingual surface. A pinch is often made on the buccal side of the lower molar for the same purpose.

When this band is made to be used as an anchor band with the expansion arch, the band is placed on the tooth after it has been burnished and the pinches soldered, and a scratch is made on the buccal side showing the proper direction in which the tube is to be placed. The seam of the band is held with a pair of pliers, the point of which has a groove of sufficient width to straddle the seam, and possesses a slide on the handle which holds the beaks together. With this form of pliers the band can be securely held and should there be enough heat on the band to melt the solder, the seam will not open.

Solder is flowed on the buccal tube which is to be attached to the band, flux is placed on the band and the tube soldered to the band at the proper place and in the proper direction. A band of this kind is shown in Fig. 107.

It is much easier to make a plain band for the deciduous molars because the gingival margin of the teeth are of as great a diameter as any other part. The band can be pinched tight around the tooth and any free portion of the band that exists around the occlusal portion can be burnished and pinched to the tooth. All pinches are united with solder as was done in the canine bands. Plain bands on molars possess the advantage of not presenting any sharp portion on the lingual side, which is a great advantage in the case of children. In those cases in which the permanent molar region requires expanding and the bands are placed on the second deciduous molars, a lingual bar is soldered to the band to engage the first permanent molar and the first deciduous molar. This style of attachment is shown in Fig. 108.

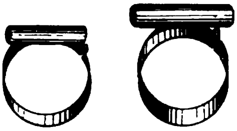

Fig. 107.
Plain molar bands with tubes.

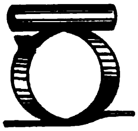

Fig. 108.
Plain band with lingual bar.

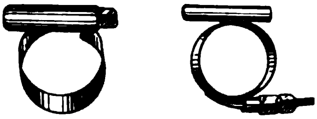

Fig. 109.
Clamp bands with clamping device on buccal and lingual sides.

Plain molar and premolar bands are also used in retaining appliances.

Adjusting Clamp Bands.—Clamp bands are made adjustable by means of a screw attachment. There are two kinds of clamp bands, those with the clamping device on the lingual side and those with the clamping device on the buccal side, as shown in Fig. 109. Each style of band has advantages which will be taken up separately. Clamp bands are made out of German silver, "non-corrosive" metal "aluminum-bronze," gold and platinum and iridio-platinum. The author prefers the band made out of a "non-corrosive" alloy which contains some copper.

The clamp band with the clamping device on the lingual side which was and is a part of the "Angle appliances," makes the strongest and best fitting clamp band known. It is adjustable to all cases and by changing the angle and position of the tube, which is in no way a part of the clamping device, has a universal use. It is now made by different manufacturers in two forms, contoured and noncontoured. In order for a contoured band to be of the greatest service it must be made for the right and left upper molars and for the right and left lower molars. A band that is contoured is also generally festooned, which weakens the device. In other words, ease of adaptability is obtained at the expense of strength, but in most cases the contoured band is strong enough. The noncontoured band is universal—can be used on either the upper or lower molars. It is contoured by the operator so as to fit the individual tooth. If the band is to be placed on the right upper molar, the screw should be bent so as to conform to the convexity of the lingual surface and the band contoured to the shape of the tooth. The gingival portion of the band should be contoured toward the center of the tooth so that the band will hug the tooth and pass under the gum and not infringe on the gum tissue. The band should be placed about two-thirds of the way on the tooth and then tightened enough to make it conform to the tooth, which also makes the gingival portion hug the tooth closely. At this stage of the operation never tighten the band to its fullest extent or it will surely be ruined. Now loosen the band and push it on the rest of the way. If there is any pain in putting on a clamp band, the technique is wrong or the band is so wide that it is infringing upon the gum tissue. If the band is too wide it should be trimmed slightly on both the occlusal and gingival side, taking off a small portion around the entire band. Never trim the band only in the approximal portion, for if that is done the band will be weakest at that point and probably tear. The object of trimming the band on both the occlusal and gingival portions is to cause the screw to always pull from the middle of the band and make the band draw evenly around the tooth. These bands are made of a material which is thin and tough enough so that they will stretch over the greatest convexity and pull into the concavities of the mesial and distal gingival portions. As the final tightening is going on, the band is burnished to the teeth at all portions that can be reached with a burnisher.

In adjusting a clamp band, with the screw on the lingual side, care must be taken that the screw lies close to the lingual surfaces of the teeth. Also the flat side of the nut must always be toward the tongue; never leave the screw and nut projecting into the mouth. Greater care should be exercised in having the screw and nut in the proper place than in getting the tube to occupy its proper position, for the tube can be unsoldered and placed at the required position, while the screw cannot be so treated. If the screw is placed as suggested it will produce little annoyance to the patient. A band placed on the teeth as described will stay without cement, but cement is used only as a prophylactic measure. A clamp band that depends upon the cement to hold it on the tooth is a poorly fitted or constructed band.

The second form of clamp band is one which has the clamping device on the buccal side. The idea of such a band is to avoid having anything on the lingual side to annoy the tongue. The angle of the tube cannot be changed, thus limiting the use of the band in a great number of cases.

One form of this band is shown in Fig. 110.

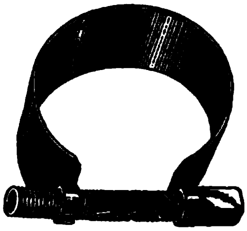

Fig. 110.
Band with clamping device and tube combined on buccal side.

Ligatures.

Ligatures constitute one of the important parts of the fixed appliance. Ligatures are of three kinds—wire, rubber, and silk or grass-line. Of the latter there are several kinds of ligatures on the market made by different manufacturers which are very nearly the same. They are made of a material which shortens under the action of moisture and continues to exert force on the teeth for a considerable length of time. The disadvantage of this ligature is that it becomes very filthy owing to the fact that it absorbs the fluids of the mouth. Great care must be taken to keep it away from the gum tissue, because inflammation will result if it should come in contact with the tissue at any point. These ligatures are found very useful in rotating teeth, for they can be used without a plain band. A loop is made and the ligature is doubled around the tooth and then both ends pulled tight and passed between the teeth and tied around the arch. Fig. 111 shows the manner of looping the ligature around the tooth, while the right central shows the manner of pulling the ligature between the teeth and tieing it around the arch.

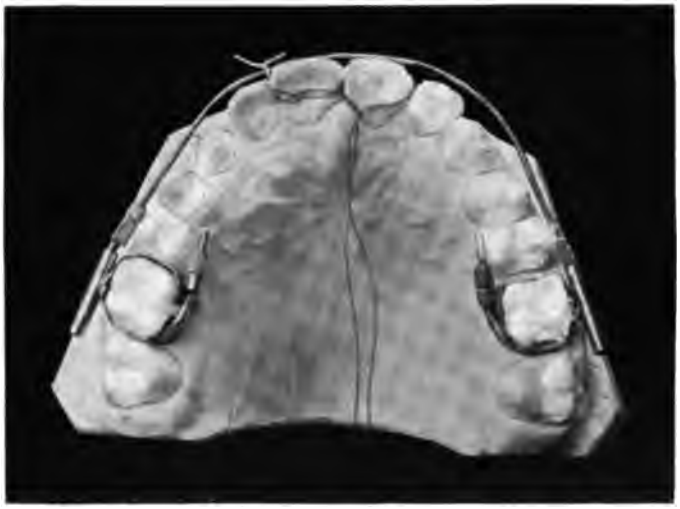

Fig. 111.

Left central shows method of looping silk ligature to rotate distal corner of teeth labially. Right central shows how the ligature is then tied to arch to rotate distal corner labially.

Rubber Ligatures are really rubber bands. They have the greatest use in intermaxillary anchorage. If used on single teeth with intramaxillary anchorage they exert too much force. These ligatures can be secured prepared for this purpose or can be made by cutting pure gum rubber tubing (Fig. 112) the desired length and thickness. The length of the ligature can be varied by cutting straight across or on the bias. Fig. 113 shows a length of the rubber tubing and several ligatures all different lengths cut from the same tube.

Fig. 112.
Rubber tubing from which ligatures of different sizes may be cut.

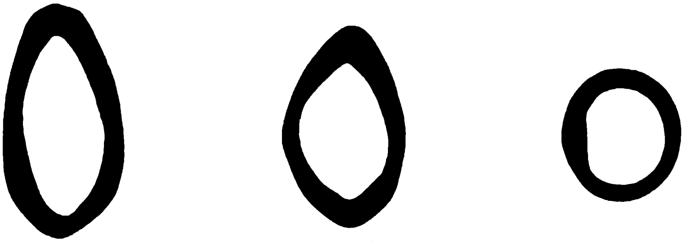

Fig. 113.
Three lengths of rubber ligatures cut from tubing shown in Fig. 112.

Wire Ligatures as introduced by Angle are very useful with the fixed regulating appliance which exerts both spring and screw force. The wire ligatures are generally a tenacious variety of brass although German silver wire has been used by some. The requirements of a good wire ligature are: softness, so it will be easily adaptable, and strength, so it will not stretch when stress is placed on it. They are made in several sizes in order that they can be easily passed through the approximal space between the contact points and the gum. A ligature which is passed around the tooth and twisted, as shown in Fig. 114, is called a plain ligature. The wire which is on the distal side of the tooth should always be placed gingivally to the arch, as there is greater danger of the distal side slipping off than there is of the mesial side. If there is a great tendency for the ligature to slip off the tooth, the wire should be passed between the teeth on the mesial side of the tooth toward the lingual;

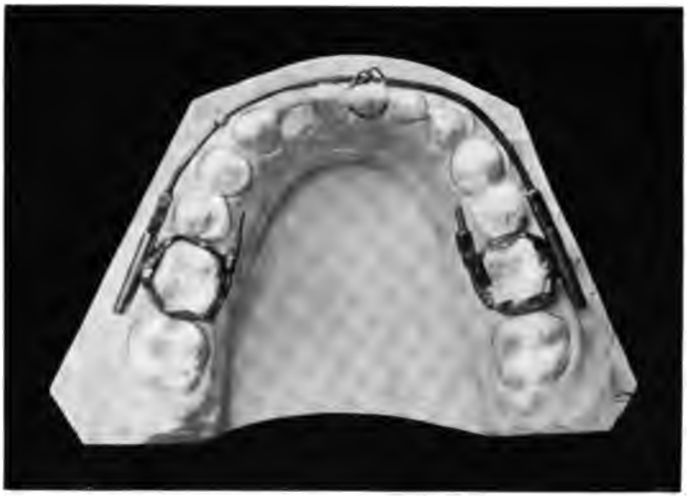

Fig. 114.
Showing plain wire ligature.

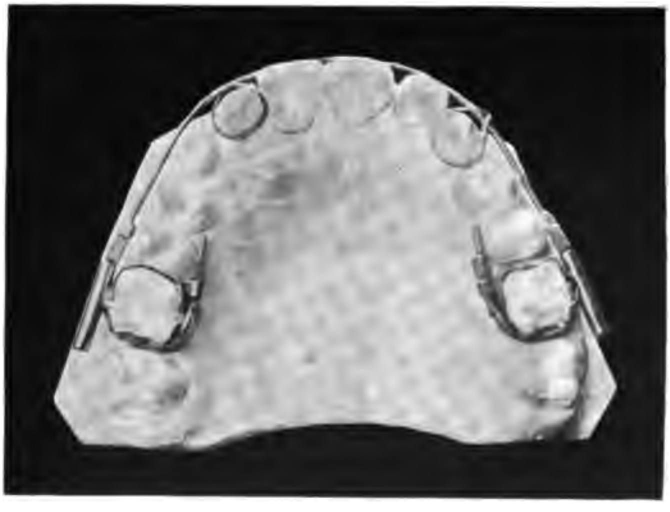

Fig. 115.
Wire wrapped around teeth before being put over arch to prevent ligature from slipping off.

brought toward the labial on the distal side of the tooth, occlusal to the arch; through on the mesial side, occlusal to the arch; and then out on the distal, gingival to the arch. This makes a wrapping of the wire around the tooth which grips it tight, besides the two ends which pass over the arch. This plan of applying the ligature is shown in Fig. 115. When the wire ligature is used to rotate a tooth, a plain band which has a tube or spur soldered on it must be employed. Then the ligature is passed between the teeth above the arch, passed around the spur on the occlusal side and next brought through the approximal space below the arch. The reason for crossing the ligature on the lingual side is that it grips the spur more securely. If a tube is used on the band instead of the spur there would be no need of crossing the ligature.

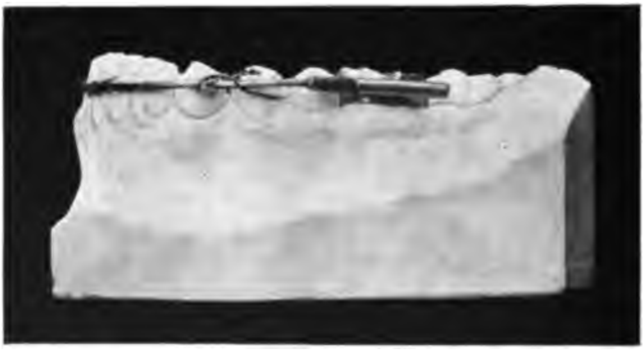

Fig. 116.
Wire wrapped around arch in front of spur to prevent wire from slipping over spur.

When twisting a wire ligature it should always be toward the right, the same as a nut is tightened. This will be found very convenient, as it will not be necessary to look which way the ligature is twisted each time it is tightened.

Where spurs have been placed on the arch to prevent the ligature from slipping, the ligature should be passed below the occlusal side of the arch and the end brought up over the gingival portion which makes one turn around the arch, and the end then passed between the teeth in the usual manner. This wrap (Fig. 116) around the arch prevents the ligature from slipping over the spur should the teeth move and the ligature become very loose. The manner of making spurs on the arches will be considered with arches.

Expansion Arch.

The main portion of the fixed regulating appliance consists of some form of the screw or spring lever. The force is the screw force and the force of the spring. The two forces have been combined in the expansion arch.

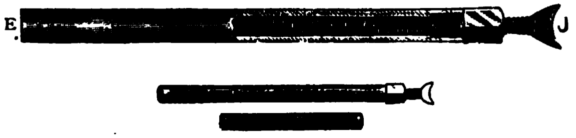

Fig. 117.
Angle's Jack-screw.

The jack-screw, which was the first appliance placed on the market and constructed so that it could be used on different cases, has been made in many different forms. The best jack-screw consists of three pieces—screw, nut and tube. The object of the tube is to cover up the free end of the screw so that it will not (Fig. 117) annoy the tongue, and it also affords attachment for one end of the appliance. There are many different ways of attaching the screw to the teeth which are to be moved. The kind of anchorage that is used will decide what form of attachment is to be made. The advantage of the jack-screw lies in the amount of force that can be exerted, the control of the force, and the firm manner in which it can be attached to the teeth. The disadvantage lies in the limited application of the device. The jack-screw exerts force only in one direction and when a number of different tooth movements have to be made, it becomes necessary to use many combinations of jack-screws, making the appliance very complicated and bunglesome. The traction screw is only a modification of the jack-screw and is used for pulling (Fig. 118). It is very seldom that either of these appliances is used, as the improvement of the expansion arch and the use of the intermaxillary anchorage makes it possible to treat cases more easily with the arch than with any other appliance.

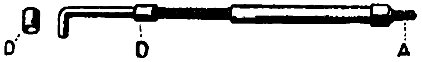

Fig. 118.
Angle's traction screw.

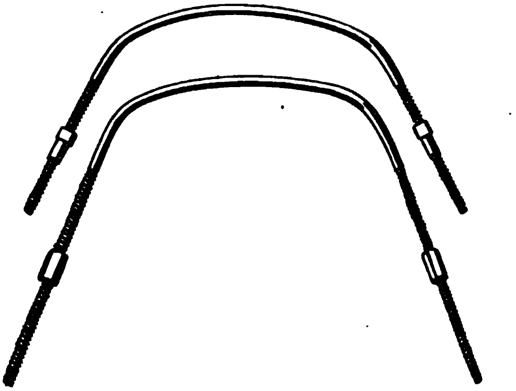

Fig. 119.
Expansion arch with different forms of nuts.

The expansion arch (Fig. 119) has been evolved from several forms of appliances until at the present time it is as near perfect as is possible to get a single appliance. It is possible to do anything with the expansion arch that can be done with any other appliance and do it easier and quicker and with less pain. It is possible to move a tooth in any direction except depressing it in the socket, which movement is very unsatisfactory with any form of appliance and anchorage. The expansion arch, or alignment wire, as some have called it, can be used with any of the three forms of anchorage. Crude forms of the expansion arch were used by practitioners for a number of years but it was not employed as a universal appliance until the writings of Angle were given to the profession. The present form of the expansion arch can be traced to the plain arch of Angle, which was a part of his device for the treatment of prominent upper anterior teeth. Case employed forms of the expansion arch in the construction of his contouring appliance. Ainsworth likewise used another form of the arch in his appliance, which has been known as the "Ainsworth appliance." The Ainsworth appliance, as originally made, was limited to the expansion of the teeth and not adapted to the various tooth movements as was the Angle arch. As stated before, the plain arch which was used in the retraction of the upper anterior teeth, may be said to be the forerunner of the modern expansion arch. In the plain arch, we have a long spring which is an ideal appliance for exerting force upon the lateral halves of the arches by means of reciprocal anchorage. With occipital anchorage, it was possible to accomplish good results in a certain number of cases, namely, Class II, Division 1. However, these results were not ideal, and in the treatment of Class I cases with its various types, and Class II, Division 2, and Class III cases, various combinations of appliances were used and the results were not always ideal. By threading the ends of the plain round arch and putting on the nut, we have an appliance which combines the force of the spring lever and the jack-screw. Then with the improvement of intermaxillary anchorage, it became possible to accomplish better results than had ever been accomplished before. With the proper adjustment of the arch and the addition of a few devices for the movement of the roots of the teeth, the results which can be accomplished are only limited by the ability of the operator.

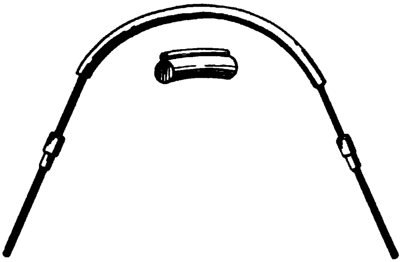

Fig. 120.
Angle's ribbed expansion arch.

The expansion arch as designed by Angle possesses a patented nut with a friction sleeve, as shown in Fig. 119, which slips in the end of the tube on the molar band. The round end of the nut fitting in the tube prevents the cheeks from working the nut loose. In order to be of any benefit the round end of the nut must fit the tube closely. Another feature of some of the Angle arches is the making of a small rib into which notches can be filed (Fig. 120) which prevents the ligatures from slipping on the arch. Owing to the fact that the rib on the arch interferes with the even spring of the arch and in a great many cases greatly irritates the lips, the ribbed arch is not used in the author's practice. Other arches are made by different manufacturers and various forms of nuts have been designed in such a manner that the cheeks will not work them loose. Lock nuts are placed on the arch; others are made with specially designed nuts to prevent them from working loose. Some nuts are made six and eight sided in order that the angles will not be so sharp against the cheek. Various other details to accomplish certain results have been added by orthodontists in the past, but they have always produced complications which, in the author's opinion, have often defeated the end sought. Expansion arches are made from various materials. German silver has been more widely used in the making of arches than any other material. It is capable of being tempered so as to give the necessary spring. Attachments to German silver arches must be made with soft solder, for the use of silver or gold solder will destroy the temper. Being antiseptic, German silver saves a great many teeth from decay, which would occur if gold or some other noble metal were used. The objection has been that they discolor. The author much prefers an appliance which demands care in order to keep it clean than one which invites decay. Gold and platinum came into great favor a few years ago, recommended by its color and the fact that it possessed more spring than German silver and could be used in a smaller gauge. Also, attachments can be made to it with hard solder without destroying the temper. In a great many mouths it discolors more than German silver and the great disadvantage is the absence of any antiseptic property. Iridio-platinum is also used and has the same advantages and disadvantages as gold and platinum. The last metal or alloy to be used is aluminum-bronze which the author believes more nearly approaches the ideal. It has all of the advantages of German silver and gold and platinum, except that it cannot be soldered with hard solder without destroying the temper. The color is better in a higher percentage of mouths than any other metal. It can be made very tough and springy, and arches of small gauge can be used.

The most universal gauge of an arch is 16. Arches of 18 gauge are often used on the deciduous teeth and in Class I cases where only intramaxillary anchorage is used. If a smaller gauge than 18 of any metal is used there is great danger of the small diameter of the arch cutting into the cheek. Arches of very small gauge have been introduced by Angle under the name of "The New Angle Appliances," which have some advantages and disadvantages. However, they have been used successfully. The 16 gauge arch will long be the standard size for it can be universally used. It possesses the required spring and strength, without taking up too much room.

Attachments for Expansion Arch.—It will often be found necessary to make three attachments to the expansion arch for various purposes: first, a spur to prevent the ligature from slipping on the arch and to control the direction in which the force is exerted, second, an intermaxillary-hook for use in intermaxillary anchorage, and third, a spur for the movement of the teeth.

Spurs to prevent the ligatures from slipping on arches made of German silver on aluminum-bronze must be attached with soft solder. On the gold and platinum and iridio-platinum arches these spurs can be attached with gold solder. The spurs can be made out of ligature wire, a tube or a wire heavier than ligature wire. There is little need of the spur being higher than the diameter of the ligature that it is to hold on the arch. The simple spur (Fig. 121-A) is made by flowing a little solder on the end of the ligature wire and then soldering to the arch. Soft solder requires the use of a soft solder flux. A saturated solution of zinc chloride makes the best the author has tried. This simple spur is of little practical value, for if much force is to be exerted on the ligature it will tear off. The half loop spur (Fig. 121-D) is made by bending a piece of the ligature wire so that it will half encircle the arch. Soft solder is flowed in the bend, the wire is held in the proper position on the arch, heat is applied, and the wire soldered to the arch. The ends of the wire are cut off leaving the spur. If this spur is soldered to the noble metal arch with hard solder it will

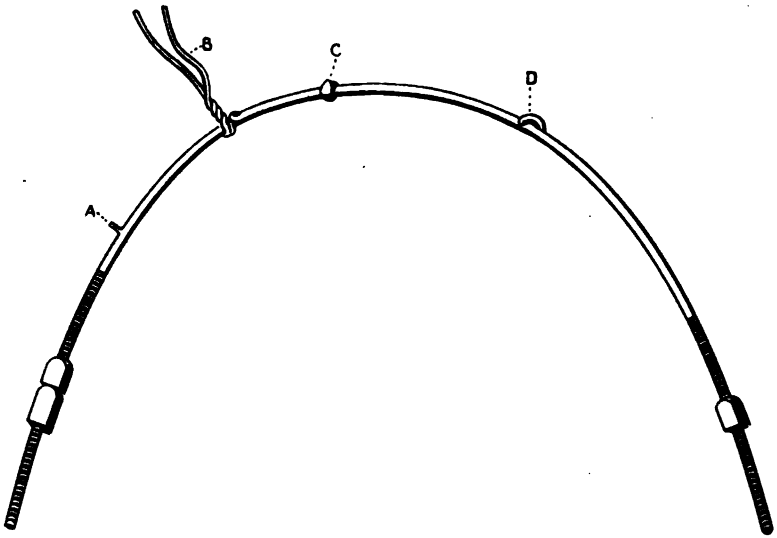

Fig. 121.

Forms of soft-solder spurs. A, simple spur; B, wire-twisted before flowing soft-solder; C, spur made by flowing soft-solder over B; D, half-loop spur.

be strong enough, providing the spur has been so placed that the ligature pulls from the entire length of the spur and not against one end. In those cases where it is necessary to open space for an impacted tooth, e. g., a second premolar, a strong spur is necessary. This is best made by wrapping a wire twice around the arch (Fig. 121-B) at the proper place and flowing solder entirely around the arch (Fig. 121-C). The ends are then trimmed and filed close, which makes a spur that is neat and capable of withstanding all the force necessary. This spur can be made as neat and strong and much quicker than a tube can be used. In using a tube for a spur, a piece of tubing is selected with an inside gauge the same as the gauge of the arch. A piece is cut from the tube of sufficient length to afford solder attachment which will be strong enough to withstand the force, the nut removed from the arch and the tube slipped to the desired position on the arch, which has previously had flux placed on it. A small piece of solder is laid on the arch at one end of the tube. The other end of the tube is then heated and the solder "pulled" through the tube. Split tubes are obtainable which can be placed on the arch without removing the nut, but they are not as strong.

The second attachment to be placed on the expansion arch is the *sheath-, intermaxillary-, or tube-hook.* These different terms are synonymous and consist of some form of attachment of the rubber ligatures when intermaxillary anchorage is used. Sometimes hooks are placed on the arches to engage a rubber ligature not used with intermaxillary anchorage, in which case the term intermaxillary-hook would be wrong. The standard form of sheath-hook consists of a piece of wire soldered to a small tube and bent in the form of a hook, as shown in Fig. 122-A. The tube is slipped over the arch and attached in the same manner that a tube is soldered to the arch, as described on page 170. Various forms of hooks have been made, but one which is simple serves the purpose as well as one of peculiar pattern. Hooks can be made by wrapping a wire around the arch and bending the ends in a hook, then soldering it so as to attach the wire to the arch, and strengthening the wire in the hook portion (Fig. 122-B). This hook is neat and strong and can be made without taking the nut off the arch. Very often the hooks can be placed on the arch so as to serve the purpose of the spur also. When gold and platinum or iridio-platinum arches are used, a piece of wire of suitable gauge can be soldered to the arch direct, with hard solder, and then bent into a hook.

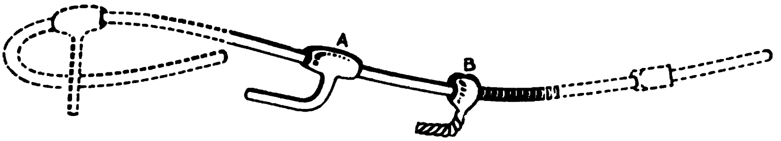

Fig. 122.

A, sheath- or intermaxillary-hook made by soldering wire to tube and soft-soldering tube to arch.. B, Intermaxillary-hook made twisting ligature wire around arch to which it is then fastened with soft-solder.

The third form of attachment to the arch is *spurs for the bodily movement of the teeth, or spurs to move the apex move than the crown, or to depress teeth.*

As these spurs must stand considerable force, it is necessary that they be firmly attached to the arch. With gold and platinum and iridio-platinum arches the spur can be soldered directly to the arch. The spur should be so placed that it will occupy a central axis of the tooth mesio-distally. The tooth is attached to the arch and held in such a manner that it will occupy a perpendicular relation to the spur. If the apex is to move more than the crown, the spur is so bent as to exert that manner of force. When German silver or aluminum-bronze is used, hard solder cannot be employed or the temper of the arch will be destroyed. In that case the wire is soldered to a tube (Fig. 123-A) which is the right size to slip over the arch. The tube is placed at the proper position on the arch and pinched slightly with a wire cutter. The pinching of the tube with the wire cutter makes the tube fit tightly to the arch so that it will not turn and slip while the arch is being removed from the mouth and placed over the flame to be soldered. The tube-spur is soldered by placing flux and solder at one end of the tube and gently heating the other end to pull the solder through the tube (Fig. 123-B).

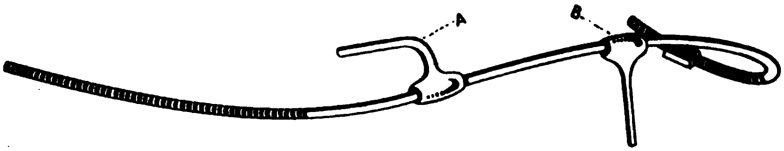

Fig. 123.

A, spur used to depress prominent canines; B, spur used in bodily movement of teeth.

Application of the Expansion Arch.—The expansion arch being the most used of all appliances, with the bands and ligatures which go with it, it becomes necessary that the principles of applying the arch be fully understood. In the hands of the skilled, or in the hands of those who properly adjust it, it becomes a valuable appliance; so valuable that it is the only form of appliance that is needed, with the occasional use of the traction screw.

It must be remembered that the arch embodies two forms of mechanical devices—the screw and the spring lever; therefore we have an enormous amount of mechanical force at our disposal.

In using the arch, one must be familiar with the various forms of anchorage in order to obtain the best results. In applying the arch to move the anterior teeth forward, we depend upon simple anchorage obtained from the molar teeth which have been fitted with bands. The tubes on the molar band must be so placed and the sides of the arch aligned so that the tube and arch will be parallel to each other before the arch is placed in the tube. If this is not done the molars will be rotated by the spring of the arch if the arch is not parallel to the tube. In moving the anterior teeth forward, if that is the only movement that is to be made, as seen in Fig. 124, the sides of the arch are only as wide as the tubes on the molar band (Fig. 125). It is unnecessary to spring the arch to get it in the tubes. The side of the arch lies

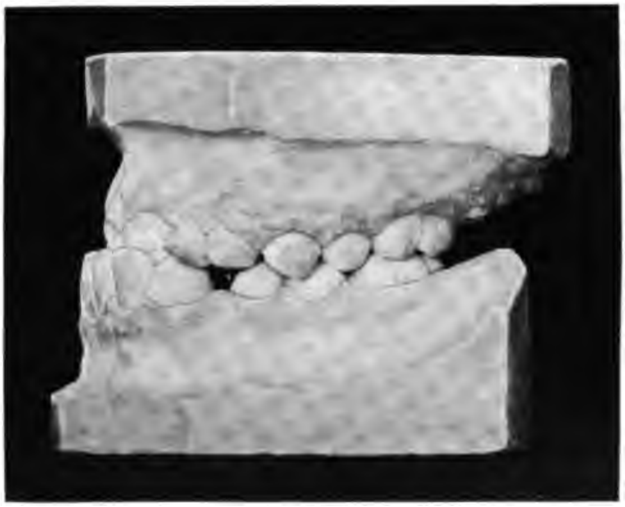

Fig. 124.
Case in which anterior teeth only need moving.

close to the teeth so as to avoid any irritation to the cheeks. The anterior portion of the arch stands slightly away from the teeth. In applying the arch to this class of cases, one side of the arch is placed in the tube on the molar band and the position noted. If the arch is too long the nut is turned forward until the arch is the proper size, and if the end projects through the tube the end of the arch is cut off so it will be covered by the tube and not irritate the cheek. The arch is again placed in the tube on the same side only, and if the tube on the band is properly placed, the side of the arch will lay close to the teeth. The position of the canine is noted and a small scratch is made opposite it and the arch removed. A bend is made in the arch opposite the canine in order that the anterior portion will lay close to the anterior teeth. This bend should be made so that it

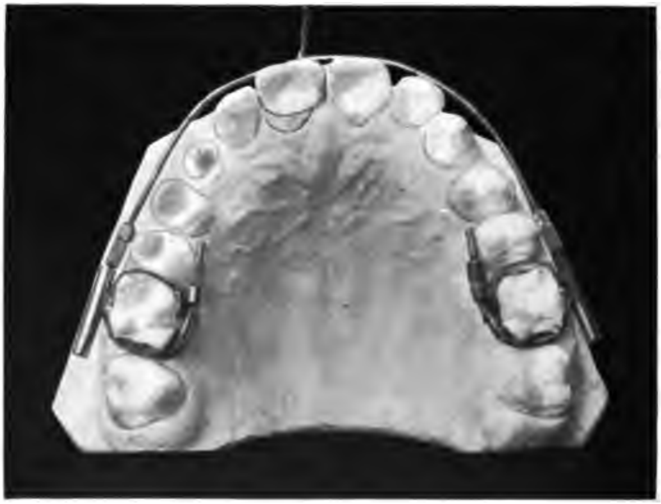

Fig. 125.
Showing relation of screws on band close to premolars and expansion arch without any expansion.

will make the anterior portion of the arch occupy the proper position to the six anterior teeth. It may be necessary to try the arch several times before the anterior portion occupies the place intended. With the same end of the arch in the same tube and holding the arch in the proper position to the anterior teeth, the position of the opposite canine is noted and marked on the arch. The arch is removed and the bend made in the canine region where marked so that the side of the arch occupies the proper relation to the tube. The side of the arch which was first fitted on the teeth is again placed into the tube and all positions of the arch noted. The side which was bent last should not be put into the tube until the nut has been placed at the proper position, the end cut off the proper length, and the side so bent that the end of the arch lies parallel to the tube, when the anterior portion of the arch is held in position with the fingers. This shows that there is no spring in the arch that will be exerted upon the molars. After it appears that the arch is properly aligned, insert the side that was fitted last into the tube, leaving the other side out, and notice what position the arch occupies to the tube when free. It should lie parallel and in exact relation to the tube, which shows there is no spring on that side. Now both sides of the arch can be placed in the tube and it should go to place without binding.

If the arch is to be applied to a case which requires expansion in the molar region, the same procedure is followed in the fitting of the arch, except that the arch is left wider in the canine region and the sides of the arch are so bent that they are parallel to the tubes but stand buccal to the tubes before the ends are inserted into them. Fig. 126 shows how the ends of the arch must be parallel to the tubes. If the arch and tube are not parallel the molar will be rotated by the spring of the arch. Very often this is taken advantage of when the molars

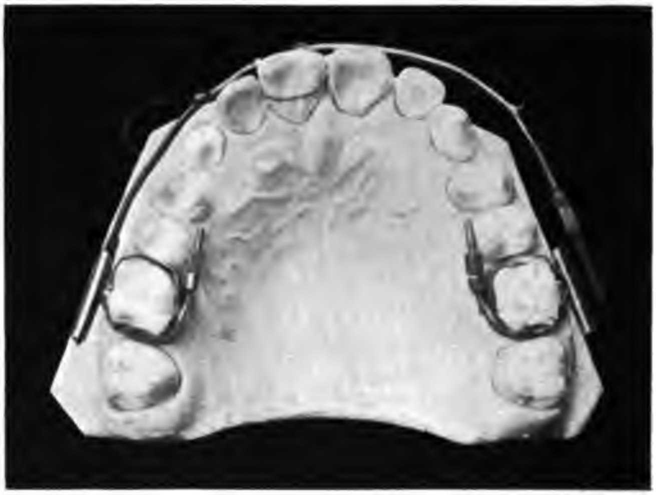

Fig. 126.
Position of arch to expand molar without rotating same.

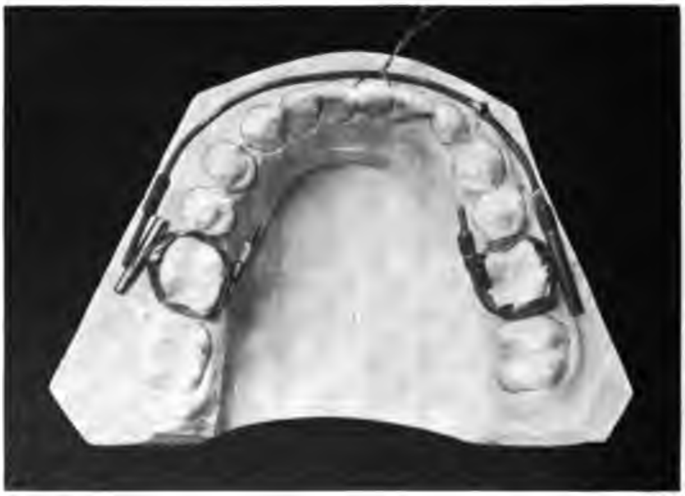

Fig. 127.
Left side shows relation of tube and arch to rotate mesio-buccal angle of molar.

are in torsi-occlusion. If the arch and tube occupy the relation shown in Fig. 127, the mesio-buccal angle of the molar would be moved buccally. If they occupied the

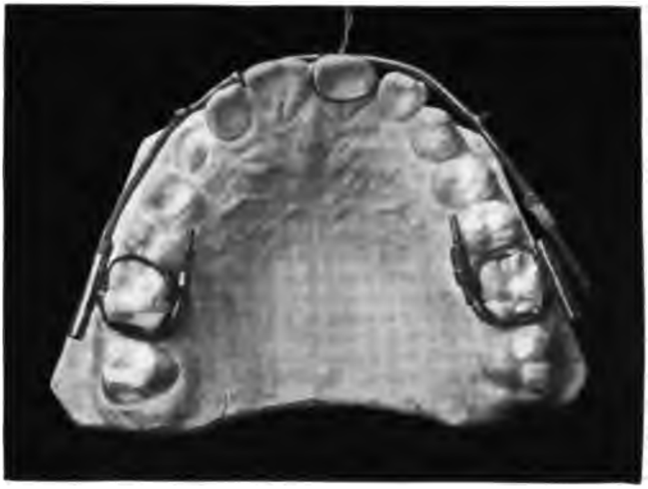

Fig. 128.
Arch adjusted to rotate distal angle of molar buccally.

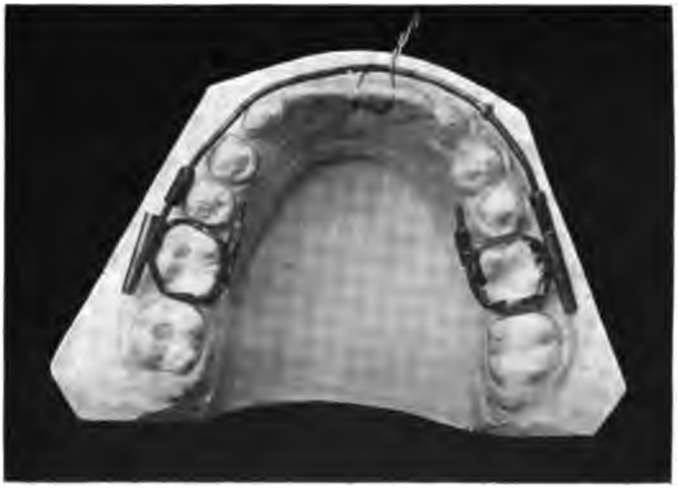

Fig. 129.
Position of arch to rotate mesio-buccal angle of molar lingually.

relation shown in Fig. 128, the disto-buccal angle would be turned buccally. If they occupied the relation shown in Fig. 129, before the arch is placed in the tube, the mesial portion of the tooth would be rotated lingually.

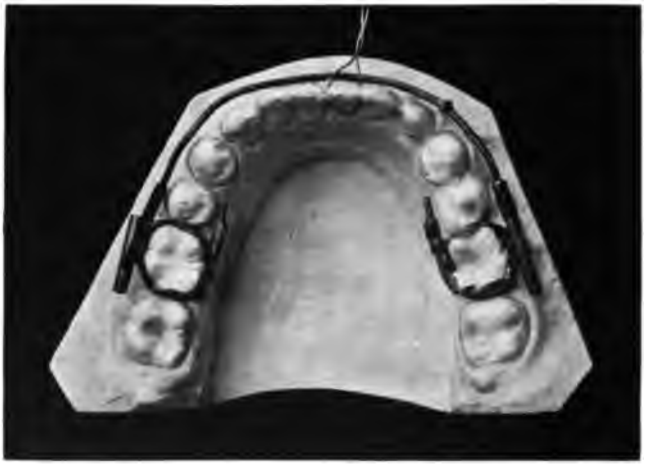

Fig. 130.
Position of arch and tube to rotate mesial angle of molar lingually and distal angle buccally.

If the tube and arch occupied the relation shown to each other in Fig. 130, when the arch is placed in the tube, the molar would be rotated in the center. Other forms of application will be shown in the treatment of cases.

CHAPTER VII.

RETENTION OF TEETH.

It has been said that the problem of modern orthodontia is one of retention. With the modern regulating appliances it becomes quite easy to regulate teeth, but to keep them in their new position has been difficult.

Forces of Retention.

Retention is the application of force to maintain teeth in their proper position in the line of occlusion. Not only must the teeth be retained in position in the line of occlusion, but they must often have force exerted upon them to assist them in assuming different angles and lengths than are present immediately after the regulating appliance is removed. It has been said that retention is the application of force to maintain and produce normal occlusion. It must be remembered that teeth are not held rigid in the dental apparatus but are constantly moving under the stress of mastication; also that they are held in position by the forces of occlusion and are constantly changing positions during the growth of the individual. Therefore the force exerted upon the teeth during retention must be exerted with that idea in view.

The forces of retention are mechanical and natural.

Mechanical Forces.

Mechanical forces are those which are exerted by artificial devices. They exert force until the natural forces can establish themselves, for it must be remembered that all cases of malocclusion are the result of some of the forces of occlusion having been interfered with. In other words, some one of the natural forces of retention has not been active.

Mechanical forces are divided into active and passive.

Passive Mechanical Forces are those which only antagonize the backward tendency of the teeth, and do not exert any force, simply resisting the efforts of the teeth to return to their former position. Angle has said that teeth should be retained against their backward tendency only. This backward tendency of the teeth can be prevented by the use of passive force.

Active Mechanical Force is obtained by the use of an appliance which possesses some force in itself, and a constant force is being exerted by the retaining appliance equal to that exerted by the backward tendency of the teeth. The advantage of such a force enables us to use a more delicate appliance, gives us a chance to regulate the force exerted upon the teeth, and permits the teeth to move under the stress of mastication, as a result of which they assume normal positions more readily, by the natural forces of retention or occlusion being able to exert themselves.

Besides being divided into active and passive forces, mechanical appliances are divided into intramaxillary, intermaxillary, and extramaxillary.

Intramaxillary Retention is where the mechanical force necessary to overcome the backward tendency of the teeth in one arch is derived from a tooth or teeth in the same arch. It may be either active or passive.

Intermaxillary Retention is where the force necessary to overcome the backward tendency of the teeth is derived from teeth in the opposite arch. It may be active or passive.

Extramaxillary Retention is where the force necessary to overcome the backward tendency of the teeth is derived from some source outside of the oral cavity. This is always an active force.

Intramaxillary retention is divided into simple, reciprocal and stationary. Reciprocal is further divided into primary and compound. Stationary should not be used as it holds the teeth too rigid.

Intermaxillary retention is also divided into simple, reciprocal and stationary. Reciprocal is again divided into primary and compound.

Extramaxillary retention is divided into occipital, cervical and facial. Neither form of extramaxillary retention is often used.

With this outline of mechanical retention we will take up the principles of the natural forces, which, it must be remembered, are the final solution to the retention of teeth.

Natural Forces.

The natural forces of retention are the same as the forces of occlusion, as follows:

1. The force of the inclined plane.
2. Harmony in the size of the arches.
3. Normal muscular pressure.
4. Normal approximal contact.
5. Normal cell metabolism.
6. Normal atmospheric pressure.

Taking the forces more in the order given above than in their order of importance, for it is hard to say which is the most important, we will begin with one with which all are familiar, viz., the "Normal relation of the inclined plane."

Force of the Inclined Plane.—Since so much has been written on this as a force of occlusion, it will be unnecessary here to go into details. However, the author wishes to again caution the reader that the lingual cusps are as important as the buccal cusps. We must keep in mind the various shapes of the teeth, especially the lower premolars; also the position which they occupy in the arch.

Fig. 131 shows the different shapes of the lower second premolars. They are illustrations made from a skull and model in the author's possession. The lower second premolar with three cusps is not as rare as might be supposed and each cusp has a definite occlusion.

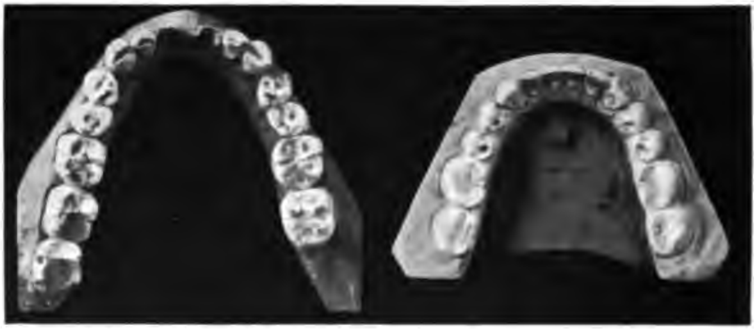

Fig. 131.
Different shapes of lower premolars, which must be considered in retention.

We must also take into consideration the fact that the lower premolars do not occupy the same angle of inclination as the upper premolars (Fig. 132). A line drawn through the buccal and lingual cusps of the upper premolars would not be parallel to one passing through the lower premolars. The line from the lower premolars would cross with the apex of the angle to the lingual of the teeth. It is the author's opinion that in a great many cases the lingual cusp of the lower first premolar has been moved too far mesially in the attempt to get it parallel with the upper. This in turn has invited the distal surface of the lower canine to turn buccally. These things we must watch, for the influence of the inclined planes in holding the teeth is well understood. We can even say at the beginning of the case whether we will have any difficulty whatsoever in getting the natural forces of occlusion to assert themselves by observing the length of the cusps. Also, in speaking of the length of the cusps in relation to the forces of the inclined planes, as a factor in retention, we should not forget the importance of the length of the cusps. In order that we may not have undue trouble in getting the teeth to remain where we wish them, and in order that the forces of the inclined planes be exercised to their fullest capacity, we must be sure that the length of the overbite be no greater than the length of the buccal cusps of the molars and premolars. In other words, when the anterior teeth are edge to edge the tips of the buccal cusps should just touch. By studying a great many models, we will find when the cases are retained that we do not always have that condition and in those cases in which it does occur, experience will prove that they are the ones in which we have our best results; they are the ones from which we

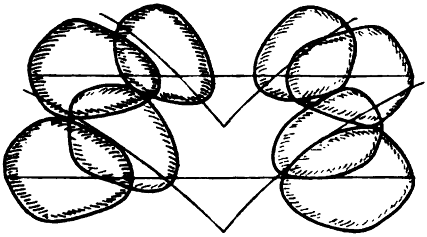

Fig. 132.
Showing the different angles which the lower and upper premolars occupy in the arch.

have been able to remove the retaining appliance early. If the length of the overbite is not the same as the length of the buccal cusps of the molars and premolars, we must so adjust the retaining appliance that the teeth will be forced to assume the normal position. Great care must be exercised in making the retaining appliance so as to assist and permit the overbite of the teeth to become normal. In this class of cases the importance of the active mechanical retaining appliance becomes apparent. The force of the inclined plane in reference to the overbite and as a factor in retention will be again taken up in conjunction with the approximal contact point.

Harmony in the Size of the Arches.—In speaking of harmony in the size of the arches in retention, very little need be said, for if the reader is familiar with normal occlusion he should understand the importance of this force of retention. However, in order that the reader may better appreciate this condition, the author will call attention to several cases in which this one factor has been neglected. It is true that harmony in the size of the arches cannot be disturbed without throwing out some other force to a certain extent. The importance of keeping the proper mesio-distal relation of the teeth in all cases, in order that we may have the proper size of each arch, is as important in the deciduous as in the permanent teeth. The evils of extraction are so apparent that it is hardly necessary to mention them. Aside from destroying the facial contour and expression of the patient, extraction renders the establishment of normal occlusion impossible, because it forever destroys the possibility of again having harmony in the size of the arches. Owing to the fact that no two teeth in both arches are exactly the same size, the arches would not be of equal size should any of the teeth be extracted.

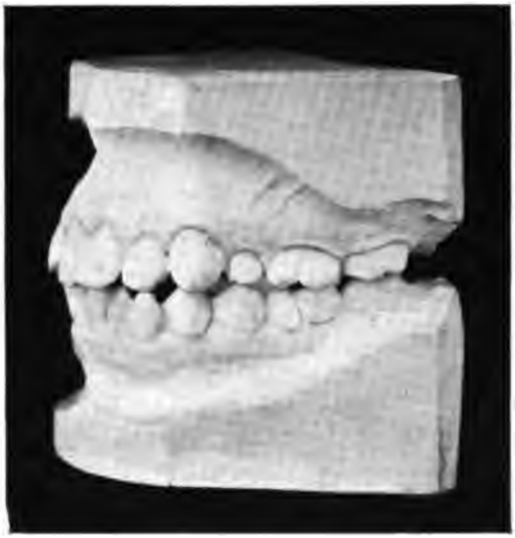

Fig. 133-A.

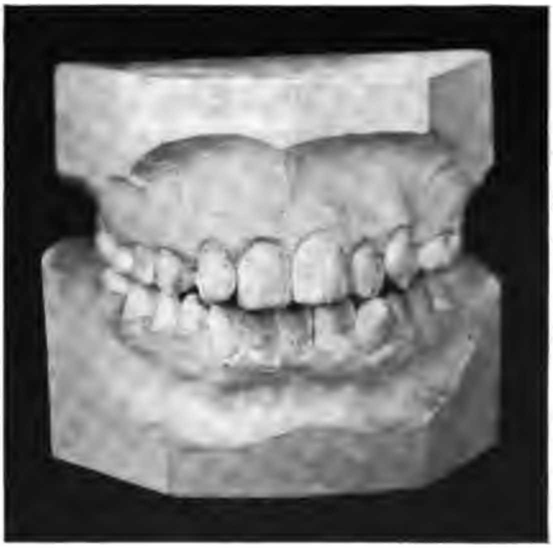

Fig. 133-B.

Inharmony in size of arches produced by extraction, making the establishment of normal occlusion impossible, also interfering with retention.

Therefore, when in a "fit of wisdom" some one takes out different teeth in opposite arches, normal occlusion becomes a thing impossible for that patient without artificial substitutes. The case shown in Fig. 133 is one of this kind. Fig. 134 shows a case with a lower second molar retained too long. An X-ray showed that the premolar is absent. The normal relation of the teeth can be seen in the models, but the molars did not remain as shown. Because of the lower molar being held distally at the time of the eruption of the upper second molar, the first molar was carried forward as it should have been and now the lower is distal to normal, not because we did not have the proper locking of the molar cusps, but because of the inharmony in the size of the arches. In the latter case, regardless of how long mechanical retention would be employed, normal occlusion of all of the teeth could not be maintained when the retainer was

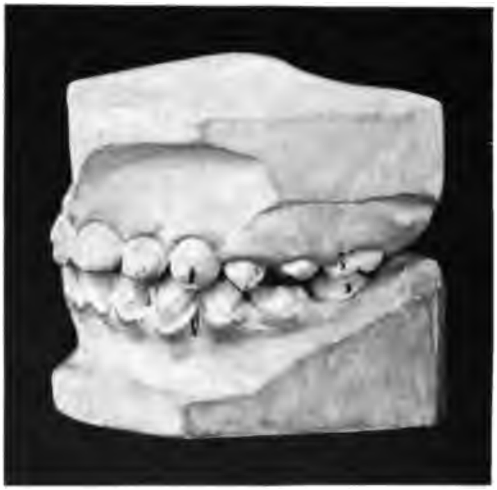

Fig. 134.
Inharmony of arches produced by the prolonged retention of lower second premolar.

removed, because of the missing natural force of retention. This brings us to the important fact that all fillings and artificial substitutes should have the proper mesio-distal diameter as well as the proper inclined plane and normal approximal contact. In fact, if one force is missing some of the others will soon be thrown out of balance.

Normal Muscular Pressure.—The importance of normal muscular pressure is well shown in any case in which the patient is a mouth-breather. Of course, some of the deformity which we see in those cases is the result of abnormal atmospheric pressure. Nevertheless we must have the harmonious action of the lips and tongue in order that normal occlusion may be maintained. The great amount of deformity which we find in cleft palates is the result of the muscular pressure which has no constraining influence. Likewise, in abnormal frenums, we see the effect of abnormal muscular action caused by the abnormal attachment of the frenum. We also find cases of large tongues which produce malocclusions. These cases must be treated with the object in view of getting the teeth in such a position that when they are retained the muscular pressure will be normal. Cases which are the result of tongue and lip habits are very difficult to retain because these habits destroy the normal muscular relations.

The importance of the action of the various muscles as a factor in producing and maintaining the proper relation of the teeth has long been a recognized fact. It is one that has also been improperly understood. It should be remembered that we have but four pair of muscles of mastication. They are all attached in the region of the ramus, that is, they are inserted into some portion of the ramus or angle; none of them being inserted forward into the body of the bone. Therefore, all of the force which they exert on the body of the mandible must be transmitted through the teeth during mastication. If we have malocclusion, we will not find the proper development of the body of the mandible because of the improper stimulation as a result of the improper muscular force. This is especially true in Class II and III cases.

The muscles of expansion play an important part in maintaining occlusion and their action is almost entirely confined to the eight anterior teeth. This is easily understood when we consider that all of the muscles of expression, except the levator menti, are inserted into the orbicularis oris; therefore, the result of their action would be apparent at the point of insertion or in the region of the anterior teeth. All of the muscles of expression acting normally will maintain normal occlusion while any of them acting abnormally will produce malocclusion. When we consider that it is necessary to have the sum total of the muscles of expression, levators and depressors of the mandible, in order to maintain normal occlusion, and that any group or any muscle acting abnormally will produce malocclusion, we readily see what a large part muscular action plays in retention.

Normal Approximal Contact.—The force of the approximal contact differs from the force of the inclined plane in several respects. First, the inclined plane of the tooth acts on the occluding incline of the tooth in the opposite arch, while the approximal contact acts on the adjoining tooth in the same arch; also, the inclined plane is an active force while the approximal contact is a passive force; that is, we see the result or the lack of it through other forces. For example, we may consider the blocks of stone in a masonic arch; as long as they are in their proper place the passive force which they exert to hold up the structure above them, is great. If one of them be removed or displaced the entire arch will collapse because of the absence of the force exerted by the approximal contact. A simpler example would be the staves of a barrel. Here the pressure of the staves is balanced by the force of the hoops. Both are passive, yet if one stave is removed or broken the entire barrel will fall to pieces. The hoops and staves of a barrel occupy very much the same relation to each other that the approximal contact of the teeth and the muscular pressure bear to normal occlusion.

The example which the author has cited above, in trying to show what is meant in regard to the passive force of the approximal contact of the teeth, may be further shown with billiard balls or any spheres of the same size. As the approximal contact of the teeth is but a point, the example of the sphere may be better. If you take three spheres and have them touching each other, lying in a straight line, you will be able to apply great pressure from the opposite sides of them providing this pressure is also in a straight line; the spheres will occupy the same relative position and will not move. However, if you deflect the line of the application of your force but slightly, one or all of the spheres will be moved from the position. Likewise, if the teeth are so arranged in the dental arch that the approximal contact points are normal, each tooth will remain in its proper position and the proper shape of the arch will be maintained. All of the active forces which are brought to bear on the teeth and arches will be resisted by the passive force of the approximal contact points of the various teeth. Many cases have resulted in failure when all other things were as near normal as was possible under the circumstances.

A position which needs watching is that of the canines, especially the lowers, for if they are not placed so that the approximal contact is correct, we will soon find them slipping out of place and the entire arch collapsing, as a result of which the normal occlusion will soon be destroyed. As may be imagined, those teeth which are not well supported by the inclined planes require a greater amount of watching than do the premolar or molar series. This brings us to the fact that there is a definite relation existing between the inclined planes and the width of the approximal contact.

Normal Cell Metabolism.—If the cell metabolism is normal we will have the proper development of the peridental membrane and alveolar process. It is evident that the teeth are supported by the above named structures and in the majority of cases the alveolar process develops to support the teeth accordingly as the forces are applied. Of course, the peridental membrane is that "membrane which covers the root of the tooth occlusally to the enamel, the fibres of which pass from the cementum into the connective tissue supporting the epithelium, into the fibrous masses of gum, into the periosteum, into the cementum of the adjoining tooth, and into the alveolar wall." This shows that the peridental membrane not only supports the tooth but also supports the soft tissue around the tooth and some of its cellular elements form the bone of the alveolar wall. This places the peridental membrane as the prime factor which has to do with the permanent retention of the tooth. If all of the other forces are normal the peridental membrane will do its part and a normal alveolus will result and the tooth will be permanently retained. Unfortunately we often find conditions which arise and make the end we wish to obtain impossible—sometimes the result of conditions which we cannot govern and other times the result of our carelessness. Factors which we cannot control are those which arise in cases of lowered vitality, especially rickets, which disturb the normal cell metabolism. In such cases the bone formed will be of such faulty structure that the teeth will not remain where placed. Those which we can govern are those which arise when we tamper with some of the forces mentioned, or so construct our retaining appliance that the natural forces cannot do their work. One of the most common mistakes is to make an appliance so the teeth will be held rigid; one that will support the teeth in every direction and not allow any of the force of mastication to fall on the teeth; constructing mechanical retainers so as to interfere with the proper approximal contact of the teeth; or hold the teeth so the influence of the inclined planes become inactive. In order that the peridental membrane may perform its proper function, in order that the osteoblasts may deposit and build bone as they should, it is necessary for the teeth to be used as they should. In other words, the proper force must be brought to bear on the teeth at all times.

Normal Atmospheric Pressure.—Another force which is difficult to classify, yet one that must be taken into consideration in the retention of teeth, is the force of the atmosphere in respiration and deglutition. The air as it passes through the nasal cavity, filling all of the sinuses as it does, exerts a wonderful pressure in the course of a year. The pressure may be slight with each breath, but when this force is added or subtracted, during the growing period of the child's life a great difference will be noted. Also, with each act of swallowing we have the pressure of the tongue and lips plus the pressure of the air as a factor which plays an important part in the retention of teeth. In order to get the advantage of the forces we must be sure that we have a normal nasal tract as well as normal occlusion. Retention will be a failure unless the child is receiving its supply of oxygen in the proper manner.

Summary of Forces of Retention.

In summing up these forces of retention, the author wishes to impress upon the readers their importance as grouped together in certain cases. Beginning with the last one, normal atmospheric pressure, we find that it is very closely associated with normal muscular pressure —so closely that if one is faulty the other is sure to be. If the nasal tracts are closed or not properly developed, abnormal muscular pressure will result, caused by abnormal breathing. In case of enlarged tonsils, we see the evil effect of long enforced voluntary muscular action, as the child endeavors to relieve the pressure and render breathing freer. It would be useless to expect retention to be a success as long as this abnormal pressure of the muscles and forced mouth-breathing is continued. No matter how long mechanical retention is employed, failure would be the final result.

As the cells of the peridental membrane respond to any force which is brought to bear upon the teeth, it is evident that any of the forces of occlusion which are wrong, will also exert some evil influence upon the cellular elements and the development of the tissue will be faulty.

Attention has already been called to the length of the overbite as compared to the length of the buccal cusps, of the molars and premolars. In the normal denture, the length of the overbite should be the same as the length of the buccal cusps. This is the condition as found in the teeth before abrasion and wear have taken place. As man advances in age, and as the teeth are worn down, we find that the wear of the molars and premolars corresponds with that of the anterior teeth. This permits the "end-to-end" bite as described by A. H. Thompson. It also accounts for the mistakes made by some who thought, because they found this end-to-end bite, that we had no normal occlusion. The author has shown that the teeth are retained by the inclined plane and the harmony in the size of the arches. As the cusp and the overbite is worn off, it is plain to all that the force exerted by the inclined plane becomes less and less. The harmony in the size of the arches is maintained and the approximal contact becomes more important. In fact, as the influence of the inclined plane is lost, the approximal contact becomes more important until it is exerting more force in maintaining normal occlusion than the inclined plane exerts. It would then be safe to say that the teeth are guided and held in place in early life by the inclined plane. When the dental apparatus becomes complete, the approximal contact becomes an important factor and as the force of the inclined plane is lost, it (approximal contact) becomes the greatest force which holds the teeth where they belong.

As the length of the cusp decreases the width of the approximal contact increases. This change can be followed in the study of the human denture and in the study of evolution. In a well-formed dental apparatus —one which has not been long used, we find that the approximal contact is but a point; also that it is some distance from the occlusal surface of the teeth. As the cusps and cutting edge of the teeth are worn off, the occlusal surface becomes near the approximal contact point until finally the contact point is close to, and later, at the occlusal surface. After the teeth become worn off to a greater extent, the contact point is reached; it is worn down and a greater surface of the teeth is in contact than was the case early in life. Instead of having but a point in contact, we have a surface. When the teeth have been in a position of malocclusion for some time, the approximal contact point becomes worn abnormally. As a result of this, it becomes extremely difficult to keep them in their proper position. That is why it has been found so difficult to make teeth, which have occupied positions of torsi-occlusion, retain their proper position in adults. It is not because of the age of the patient but because of the abnormal approximal contacts. Therefore, the relative importance of the inclined plane and the interproximal contact as a factor in retention, changes during the lifetime of the individual.

The natural forces of retention must always be considered in the construction of the mechanical retaining appliance. The mechanical device is only to aid nature and nothing must be done which will interfere with the forces of occlusion. With this view in mind we will pass to the consideration of mechanical devices.

Mechanical Forces of Retention.

Simple Passive Intramaxillary Retention.—The first form of mechanical retention used was simple passive intramaxillary. In this form, we take advantage of some tooth that has not been moved to hold a tooth that has been moved. We depend upon the large and favorably located teeth to retain the ones which have been moved. It does not require much force to prevent a tooth from returning to its old position; therefore, as a rule, the retaining appliance can be made very simple. It may be a band and spur, as shown in Fig. 135. In making use of the band and spur, as far as the principle is concerned it makes no difference whether the band is placed on the tooth that has been moved or on the firm tooth. The advantage of this form of retention is the ease with which it can be constructed. Having a firm tooth as a base no mechanical construction of the appliance is needed to assist in retention. Simple passive intramaxillary retention is seldom used, for in most cases of malocclusion it becomes necessary to move so many teeth that there are none that have not been moved which can be utilized as the base for retention.

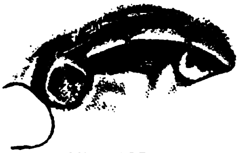

Fig. 135.
Simple passive intramaxillary retention.

Simple Compound Intramaxillary Retention.—Compound retention of this variety is where a number of teeth which have been moved are retained by one or more teeth which have not moved. This is the style of retention used in cases resulting from lip habits, where the superior anterior teeth have been forced outward without disturbing the canines. After the four anterior teeth have been placed in their proper position, bands are placed on the canines with a wire running labial to the incisors, soldered to the canine bands, which will prevent the superior anterior teeth from again retruding. This form of device is simple compound intramaxillary retention.

In some cases, where there is a great tendency for the corrected tooth to return to the old position, the retainer is made in such a manner that it will exert an active force. This is accomplished by having the spur made from some material which possesses spring, and so made and adjusted that a spring force will be exerted upon the malposed tooth to overcome the backward tendency.

Stationary Intramaxillary Retention could be produced but is not desirable. In those cases in which the teeth are held rigid, it has been found that the normal cell metabolism is interfered with to such an extent that the teeth do not become firm. Therefore, every effort should be made to allow the teeth to respond to the forces of mastication as much as possible.

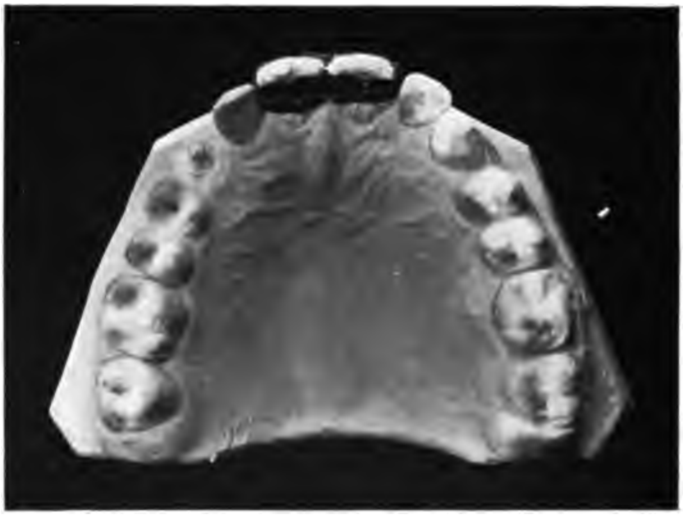

Fig. 136.
Simple primary reciprocal intramaxillary retention.

Reciprocal Intramaxillary Retention is used in those cases which have been regulated with reciprocal anchorage. It is the pitting of the backward tendency of one tooth that has been moved against the backward tendency of another tooth which has also been moved. The simplest form of this principle is shown in Fig. 136, where two central incisors have been moved toward each other. By passing the ligature wire around them, one is made to retain the other. This is primary reciprocal retention of the passive variety—primary, because the appliance is holding only the teeth to which it is attached; passive, because there is no spring or pull in the ligature, which only occurs as the teeth try to return to their old position.

Compound Reciprocal Retention is where the backward tendency of two or more teeth is overcome by the backward tendency of two or more other teeth, which are trying to return in an opposite direction. Furthermore, the appliance is so constructed that it is attached to less teeth than the number that are being retained. With this form of appliance we have the greatest working efficiency. Compound reciprocal retention is used in the active and passive form. Compound reciprocal passive intramaxillary retention is often employed in retaining the six anterior teeth. An example is shown in Fig. 137, in which the six anterior teeth have been moved. All of the teeth have been moved from positions of lingual occlusion. By placing bands on the canines and soldering a wire on the lingual sides of the bands so that it will engage the lingual surface of the incisors, the six teeth are retained by the one appliance. The lingual tendency of the canines is overcome by each other and the backward tendency of the incisors is also overcome by the same appliance, which justifies the use of the term compound reciprocal intramaxillary retention. As there is no spring to the appliance, it only exerts force as the teeth try to return, being called passive retention. This principle can be carried further, and by placing bands on the molars and canines and soldering a wire on the lingual side of these bands, the retainer can be made to retain all of the teeth in the arch, if they have all been in lingual occlusion.

In using the lingual retainer just described on all of the teeth in one arch, it has often been found that the force of the teeth may be greater than the passive force exerted by the appliance. As a result, the arch would contract and the teeth would assume a position of malocclusion, much to the chagrin of the operator. To avoid this, active compound reciprocal intramaxillary retention was devised, which consists of making the lingual retaining wire out of some material having a spring, and it is so constructed that the pressure of the spring can be regulated. If the teeth are exerting more force than is exerted by the retaining wire, the wire is removed from the small open tubes holding it in place and more

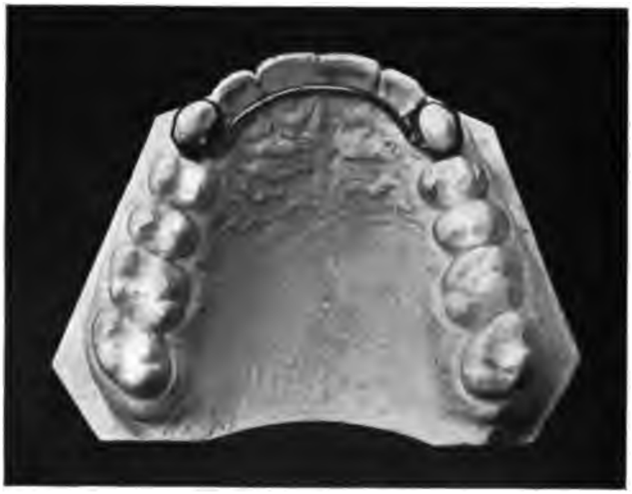

Fig. 137.
Compound reciprocal intramaxillary retention; lingual bar.

spring given to the lingual wire, which makes the appliance of sufficient strength to hold the teeth (Fig. 138). By making an appliance of this kind we are able to have one of smaller bulk and have absolute control over the teeth at all times. There are other forms of retaining devices utilizing this principle which are fully described in Chapter IX.

Intermaxillary Retention is where the force necessary to overcome the backward tendency of the teeth in one arch is derived from some teeth in the opposite arch. This form is primary and compound, active and passive, also simple and stationary. Primary passive intermaxillary retention is where the backward tendency of one tooth in one arch is overcome by a tooth in the other. The most common form of this retention is when the loss of the upper second deciduous molar makes it necessary to hold the upper first molar distally. This form of retention can be taken advantage of by cementing a pin on the occlusal surface of the lower second deciduous

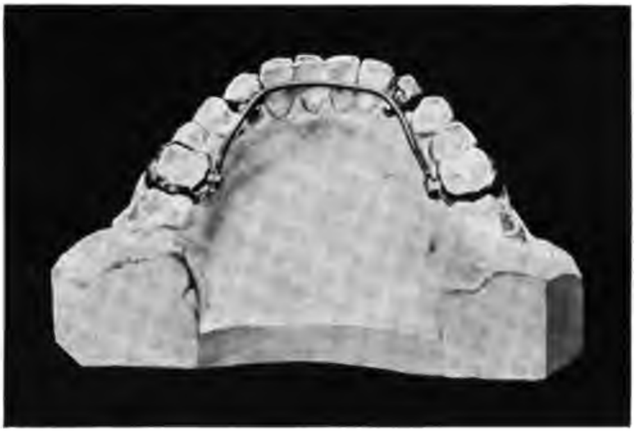

Fig. 138.
Simple compound reciprocal intramaxillary retention, with removable lingual bar.

molar so as to engage the mesio-occlusal surface of the upper first molar. The favorable location of one tooth to the other makes possible this form of retention.

Active Primary Intermaxillary Retention is where the force necessary to overcome the backward tendency of a tooth in one arch is obtained from a tooth in the opposite arch. An example of this is shown in Fig. 139 in which a canine, which was in infra-occlusion, has been brought to the proper position. In order to retain it there a rubber band is attached to the lower first premolar.

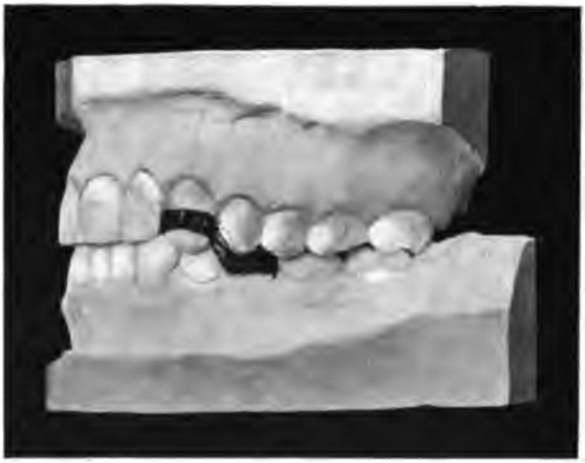

Fig. 139.

Retention of superior canine, which was moved from infra-occlusion retained by rubber band from lower premolar, which make active primary simple intermaxillary retention.

Reciprocal Intermaxillary Retention is where the backward tendency of the teeth in one arch is overcome by the backward tendency of the teeth in the opposite arch. This may be primary or compound, but in most cases is compound. It may be used either active or passive.

Passive Reciprocal Simple Intermaxillary Retention is where the backward tendency of the teeth in one arch is overcome by the backward tendency of the teeth in the other arch, the appliance being so constructed and attached that the teeth will be tipped if sufficient force is exerted upon the appliance. The appliance is made so that it exerts force upon the teeth only as they try to return to their old positions. Should the appliance become bent or the teeth slip slightly no force will be exerted which will regain what has been lost. Passive intermaxillary retention has been used for some time in the retention of Class II, Division 1 cases, or in fact in any class of cases in which the mesio-distal relation of the teeth has been changed.

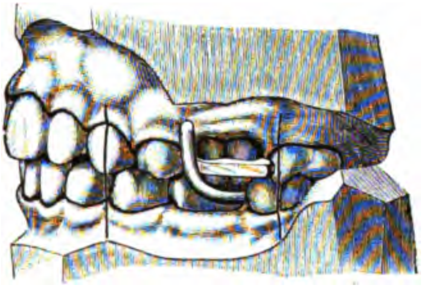

Fig. 140.
Plane and spur, which is passive reciprocal intermaxillary retention. (After Angle.)

Plane and Spur Retention.—A form which was much used was described by Angle and has been known as the "plane and spur." It consists of a band fitted to an upper and lower tooth, generally the first molars, which have been chosen on account of their size and strength. A plane is soldered on the buccal surface of the upper band (Fig. 140) and a spur on the buccal surface of the lower band for the purpose, in Class II, of engaging the anterior part of the plane on the upper molar band.

This retainer antagonizes the backward tendency of the teeth, but the disadvantages lie in its principle: First, it depends only upon the firm location of the molar teeth to supply the resistance necessary to prevent the backward tendency of the teeth; Second, there is no attachment or construction of the appliance which will give the teeth any assistance; and, Third, the force is entirely passive, that is, if the teeth drop backward the least bit, there is no way of regaining the movement lost. It very often happens that the teeth to which this appliance is attached will be tipped, as shown in Fig. 141. This allows the teeth mesial and distal to the ones to which the appliance is attached to assume incorrect positions. Many different forms of the plane and spur have been used and attached to different teeth, but the principle has always remained the same.

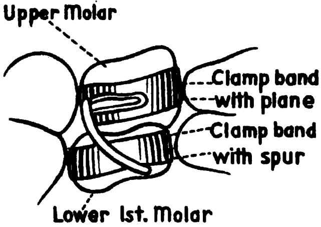

Fig. 141.
Shows how force of passive retention in Class II tends to tip upper and lower molars.

Passive Reciprocal Stationary Intermaxillary Retention is that form in which the teeth in one arch are made to overcome the backward tendency of the teeth in the other, the appliance being so attached that the teeth supporting it cannot tip at all. Fig. 142 illustrates very clearly what was intended to be done, but the great disadvantage was that it held the teeth too firm and for that reason this form of retention was used by the author only on one case.

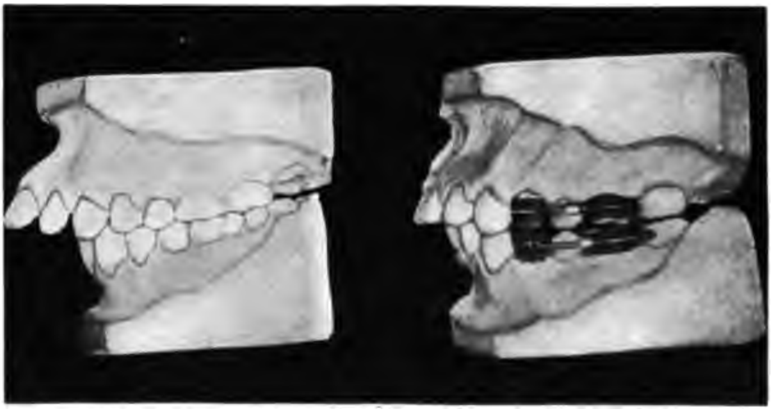

Fig. 142-A. Fig. 142-B.

Showing passive reciprocal stationary intermaxillary retention, which is a very unsatisfactory form to use.

Active Reciprocal Intermaxillary Retention is where the force necessary to retain the teeth which have been moved in one arch is derived from the teeth which have been moved in the opposite arch, and is of an energetic nature. Various forms of this principle are employed —e. g., primary, when a tooth in one arch is used to retain a tooth in another arch. This form is used when

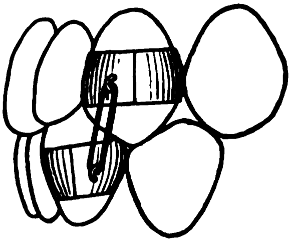

Fig. 143.

Active primary reciprocal intermaxillary retention used to retain canines which have been in infra-occlusion.

a canine in the upper arch, which has been moved from infra-occlusion, is used to retain a lower tooth moved from the same position, by placing a band on both teeth and connecting them by means of a light rubber ligature. Fig. 143 illustrates such a condition.

Compound Active Reciprocal Intermaxillary Retention is used when the six anterior teeth of one arch are made to retain the anterior teeth in the opposite arch, the teeth in both arches having been moved. This is the form of retention used in the retaining of cases caused by tongue habits. The use of the rubber ligature which supplies the active force makes a better retention than any other.

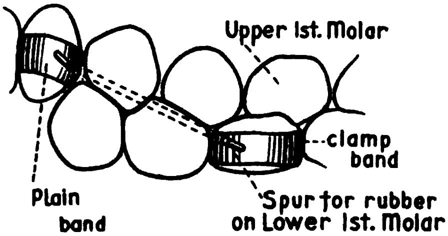

Fig. 144.
Compound active reciprocal intermaxillary retention used in Class II, Division 1 cases. (See also Fig. 222-B.)

Compound active reciprocal intermaxillary is most useful in the retention of Class II and III cases. One form is shown in Fig. 144. The details of construction are discussed in Chapter IX, under treatment of Class II and III cases. The chief advantages of this form of retention are that it prevents the tipping of the molars and can be so adjusted as to aid the settling of the inclined planes of the teeth. The use of this form of retention has displaced all others in the author's practice for Class II and III cases. It will be considered further in the treatment of cases.

Extramaxillary Retention is that form in which the force necessary to retain the teeth is derived from same source external to the oral cavity. It is derived from the occipital, cervical or facial region and is very little used. The author has never had occasion to make use of either form.

CHAPTER VIII.

IMPRESSIONS AND MODELS.

Preliminary Consideration of Cases.—One of the essential things in the treatment of cases is a thorough understanding of the conditions. The case must be studied with the object in view of learning the cause of the malocclusion. The history of the case should be gone into in order to learn if nasal obstructions, constitutional conditions or habits have played a prominent part in the production of the malocclusion. Very little should be said in regard to the prognosis of the case until after the condition has been studied from models made from good impressions.

It is very necessary that an orthodontist be able to take the impression skillfully and without annoying or agitating the patient. Many patients have been frightened away from the operator because of the crude manner in which he obtained the impression.

Taking the Impression.—In order that we may obtain the best impression possible—for without a good impression we cannot have a good model—plaster must be used. The advantages of plaster are so apparent that it is hardly necessary to mention them here. It is the only material that will give an accurate reproduction of the condition as it exists. The more pronounced the malocclusion the greater the need of plaster. In the hands of the skilled operator it is no more objectionable to the patient than modeling compound. Modeling compound has a place in dentistry, but not in orthodontia.

The teeth should be carefully cleaned and the mucus removed from the teeth and gums as thoroughly as possible. A tray larger than the dental arch should be selected, being perfectly smooth on the inside and having high walls, as shown in Fig. 145. One with a quarter of an inch between the teeth, alveolar process and the edge

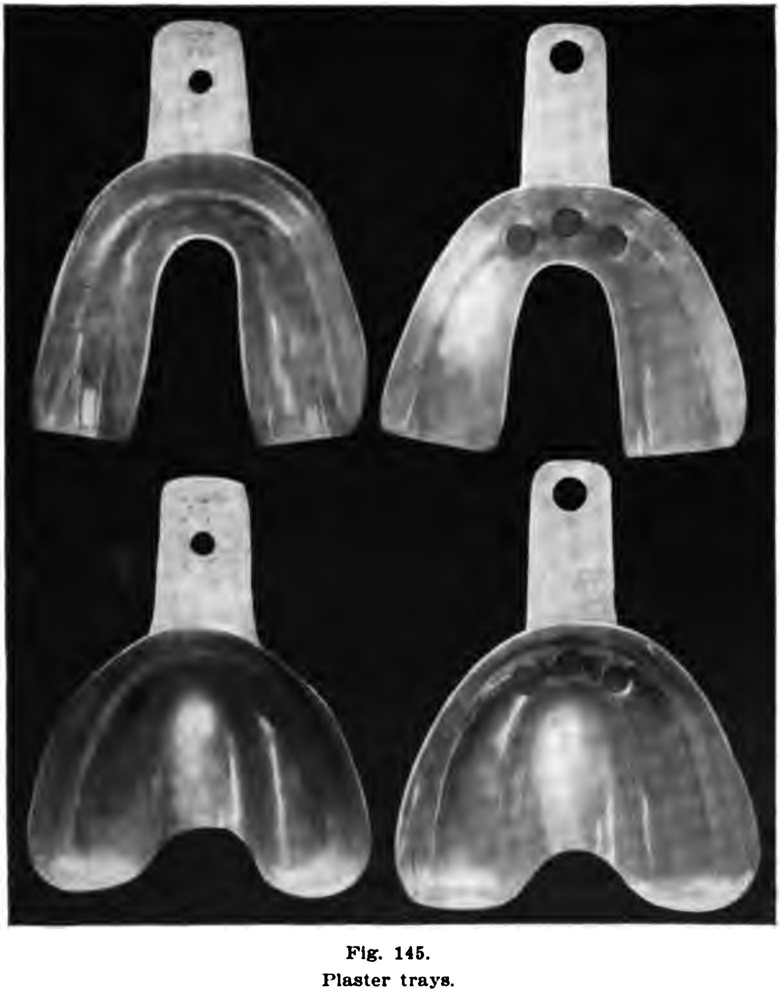

Fig. 145.
Plaster trays.

of the tray is preferable. The tray should be of a material that will permit bending so that it can be shaped to the dental arch. The tray must be placed in the mouth and the cheeks and lips pulled over it, which enables the operator to observe how it fits and the patient to become familiar with the sensation. If the patient has a tendency to gag or is frightened the impression must not be taken until all fear is allayed, and a tray should be selected that will not produce nausea.

When about to take the impression the patient is carefully protected with a suitable towel or large apron.

Fig. 146.
Plaster bowl, which must be smooth inside, so that hard plaster can be removed.

It is unnecessary to distribute débris of plaster upon the clothes of the patient, or to allow it to accumulate upon the floor of the operating room. All that is needed is an ordinary towel with the corners pinned up to make a pocket into which the excess pieces of plaster are dropped when the impression is being taken.

A quick setting plaster should be chosen so that it will not be necessary to keep the material in the patient's mouth very long. A small plaster bowl (Fig. 146) hold-

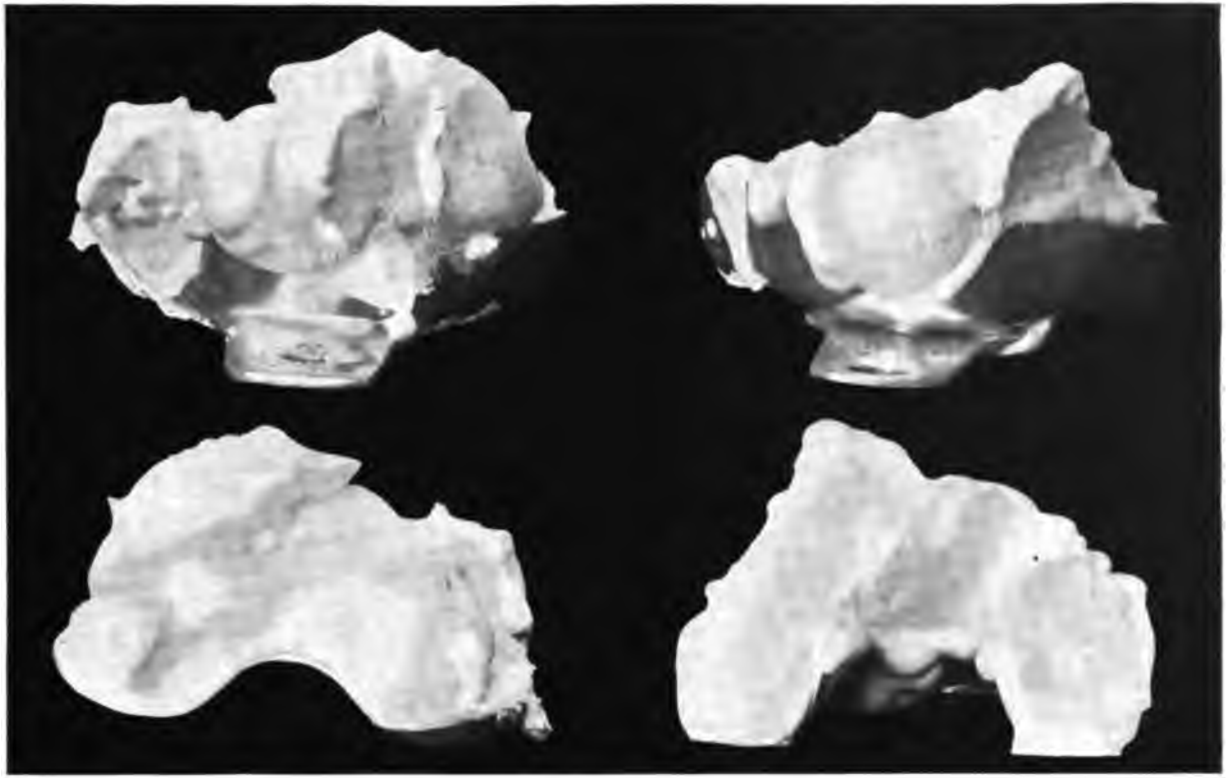

Fig. 147. Manner of placing plaster in trays so that excess can be worked under lips.

ing the required amount of water is used, and the use of salt depends upon the rapidity with which the plaster sets and the ability of the operator to work rapidly.

The plaster is slowly sifted into the water until the water will take no more plaster. Then it is carefully removed from the bowl and placed in the tray, as shown in Fig. 147. A liberal amount of plaster should be inserted around the buccal and labial parts of the tray, but none should be placed in the palatal portion. The tray is placed in the mouth and the portion of plaster which has been placed on the labial part and handle of the tray, is carefully worked under the lip and cheek. This is done to insure no air being caught between the lip and impression. After the plaster has been placed under the lip, care must be taken that the impression tray is in the proper position—not too far distally or mesially, nor too far to the buccal and straight with the median line of the face. If in forcing the upper tray into place, some of the plaster is forced over the palatal portion of the tray, it should be removed at once with a mouth mirror. In taking the lower impression, just before the tray is forced down and after the plaster has been placed under the lip, the patient should be instructed to raise the tongue and while the tongue is raised, the tray is forced down. This insures a good impression of the lingual portion of the mouth. Also, the fingers should be passed back to the disto-buccal portion of the tray and the cheek forced buccally; for often the cheek is caught under the heel of the impression tray, thus spoiling the accuracy of the impression.

The tray is held firmly until the plaster begins to set and then pieces of cotton or bibulous paper can be used to wipe the saliva out of the mouth and to remove the loose pieces of plaster. After the plaster is hard enough to hold the tray in place, the portion of plaster on the outside of the tray is removed. Any portion which breaks off below the border of the tray should be saved, others thrown into the pocket made by pinning the towel at the corners. After all pieces of the plaster have been broken away from the tray, the tray is then removed, leaving the impression intact in the mouth. With a sharp knife, using a chisel stroke, grooves should be made in the impression over the canine eminences, as that is the most convenient way to break the impression. These grooves should be made narrow with straight walls, as the straight walls are necessary to use as a fulcrum for the knife blade in breaking away the plaster. The positions of the teeth should be fixed in mind, and the lip pulled out of the way so as to get an idea of the anatomy of the parts, and the grooves cut through the plaster only far enough to permit it to break. The blade of the knife is placed in the groove and one piece is pried out. Whether the center piece or the side pieces are broken away first depends upon the position of the teeth. In breaking the buccal portions away, the thumb should be placed against the anterior end of the broken plaster and the finger placed along the buccal side of the same so as to protect the cheek. After the buccal and labial portions have been removed, the palatal portion is then taken out. Occasionally an upper impression can be taken out in three or four pieces, but a greater number would not spoil the value of the impression. In removing the lower, the same procedure is followed. The lingual portion is broken as near the median line as possible by pushing lingually on one side of it from about the region of the first molar. In removing the pieces, those from the right side should be laid on the right side of a blotter or piece of clean paper and those from the left side, on the left side of the blotter, and all the other pieces placed in their respective relations on the paper.

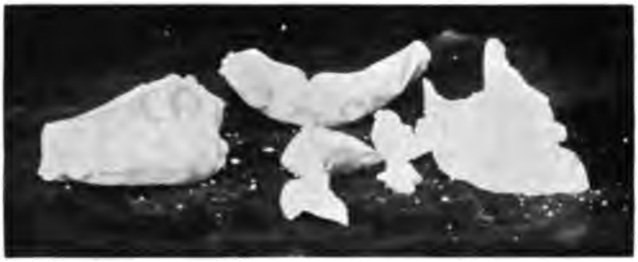

Fig. 148-A.

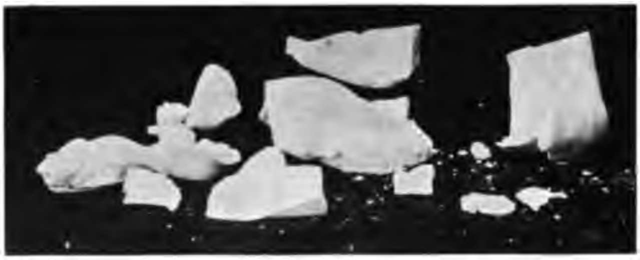

Fig. 148-B.
Impressions removed from mouth. A, upper impression; B, lower impression.

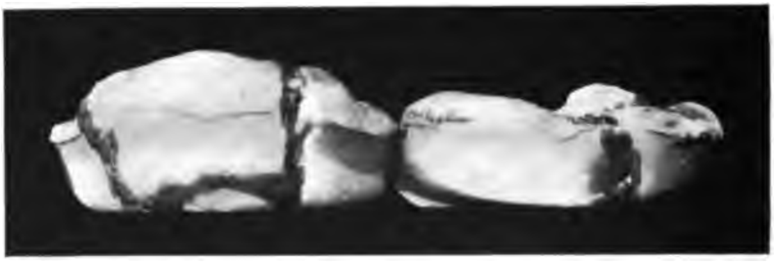

Fig. 149.
Impressions put together with sticky wax.

The pieces of the impression must be laid away until they are dry and then placed together and held by sticky wax. In putting these impressions together, the small pieces of the right side must be stuck to the large pieces of the right side, and so on, and then the right and left portions of the impression put together. If trouble is encountered in getting the halves of the impression to stay together, they can be braced by sticking a match across the back with sticky wax. Fig. 148 shows the upper and lower impressions as they are removed from the mouth. Fig. 149 shows the appearance of the upper and lower after they are put together.

Varnishing the Impression.—The impression is then coated with separating medium. The author has obtained the best results from the use of shellac and sandarac varnishes, as recommended by Angle. The consistency of the varnishes can be learned only from experience. Alcohol must be added to the varnishes from time to time to keep them thin enough. One coat of shellac is placed on the impression with a fine brush from a solution so thin that all of the shellac will soak into the impression. If this first application leaves a coating on the impression, the varnish is too thick and the impression will not produce a good model. The object of this coat is to fill all of the pores in the impression, color the impression for a certain distance, and act as a filler for the next coat. The second coat is applied only after the first is thoroughly dry, and at least three hours should elapse after the first coat is put on before the second is applied. This second coat should cover the entire surface of the impression, and is taken from the same bottle as the first. The purpose of the second coat of shellac is to fix a gloss on the impression. After this second coat it would be possible to separate the impression from the model if it was poured then. However, in order that the teeth may have a better gloss and that the impression can be separated more readily, a coat of very thin sandarac is placed in the impression of the teeth and the rough portions of the impression. Care must be taken to avoid getting any of the sandarac on the gingival margins of the teeth. After the last coat of varnish is dry, the impression is ready to pour.

Pouring the Model.—The plaster used for the model should be one that will be reasonably hard and must not set too slow. The plaster is carefully sifted into the water so as to avoid bubbles. When the water has taken up all of the plaster, the mixture is placed in the impression of the teeth with a fine brush. In filling the impression, begin at one side at the last tooth or heel and fill from there entirely around the impression. The plaster is carefully placed in the teeth so as to expel any air bubbles that may occur in their cusps. After the teeth have been filled with the brush, the remaining portion of the impression can be filled with the spatula and

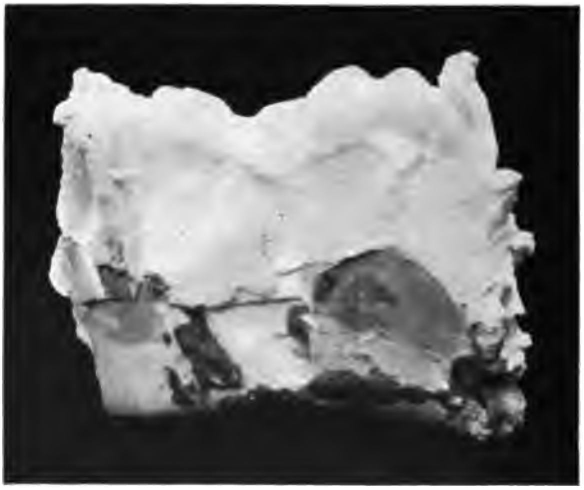

Fig. 150.
Impression poured before being turned over on glass slab.

a large amount of plaster should be placed on the impression, as shown in Fig. 150. By this time the plaster should be hard enough to support the weight of the

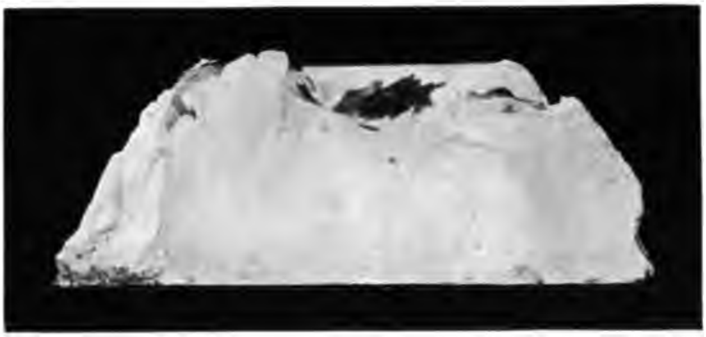

Fig. 151.
Impression turned over and placed on glass slab.

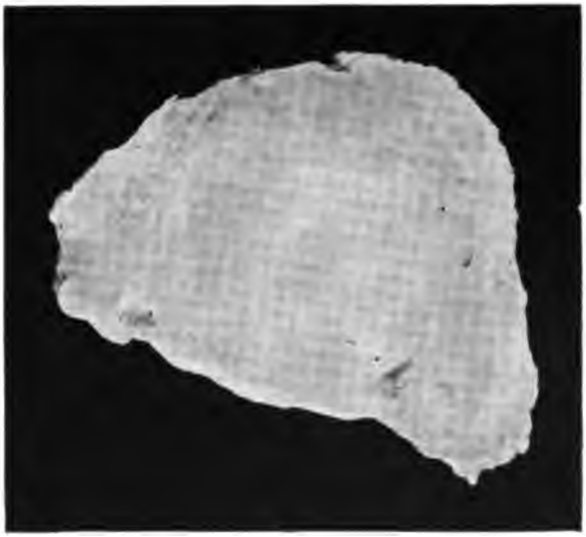

Fig. 152.
Impression removed from glass slab, showing square corners.

impression and also stiff enough so that it will not run out when turned upside down. The impression is now turned upside down on the glass slab, as shown in Fig.

151, and the plaster pulled up around the impression. The disto-buccal corners of the plaster must be left square, as shown in Fig. 152, for the reason that they represent the corners of the finished model.

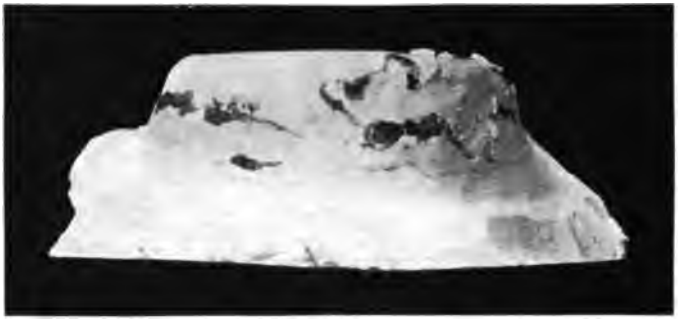

Fig. 153.
Plaster trimmed away from border of impression previous to separation.

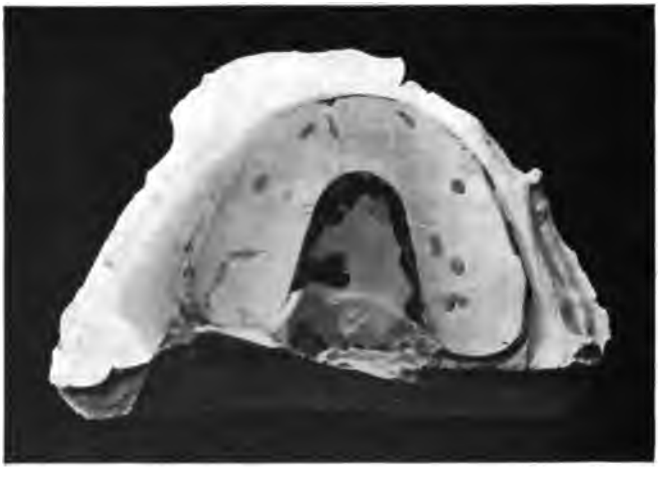

Fig. 154.
Occlusal surface of impression trimmed to show discoloration from shellac varnish.

Separating the Model.—After the plaster has become hard the impression can then be separated from the model. The plaster is trimmed away from the edge of the impression until the border can be seen plainly. Fig. 153 shows the preliminary trimming and Fig. 154 the manner of trimming the occlusal portion until the stain of the shellac can be seen. A groove is then cut into the impression as near the gingival portion of the teeth as possible so that it will extend from the right distal corner to the left distal corner (Fig. 155). Then grooves are cut parallel with the long axis of the teeth and at right angles to the first groove. These grooves are carefully cut into the impression until the stain from the shellac shows. The pieces are then pried off by prying toward the occlusal surface. No piece of impression larger than a tooth should be removed at one time. When prying off the impression, care must be taken not to break off the teeth.

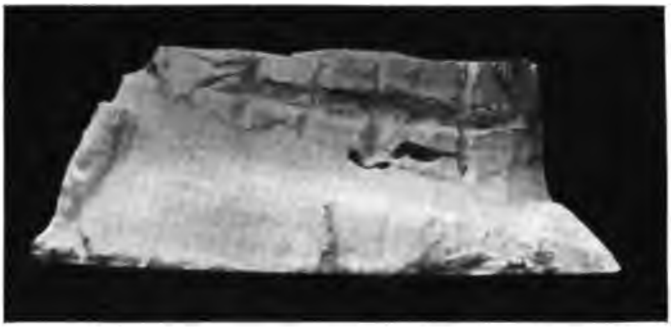

Fig. 155.
Grooves cut into impression before separation.

Trimming the Model.—After the impression is removed, the model is then ready to be trimmed. The portion of the model representing the teeth and alveolar process is known as the anatomical portion. The rest of the model is known as the base or art portion. In handling the model, the anatomical portion should not be touched with the fingers.

The anatomical portion of the model is measured in the highest portion and that length represents three-fourths of the height of the completed model. Therefore, the art portion of the model is one-third of the height of the anatomical portion. These measurements can better be understood by referring to Fig. 156. After this measurement has been obtained the art portion of the model is marked on all sides and then the base is trimmed to the line. The lower model should always be trimmed first. The base should be finished smooth before any side is trimmed.

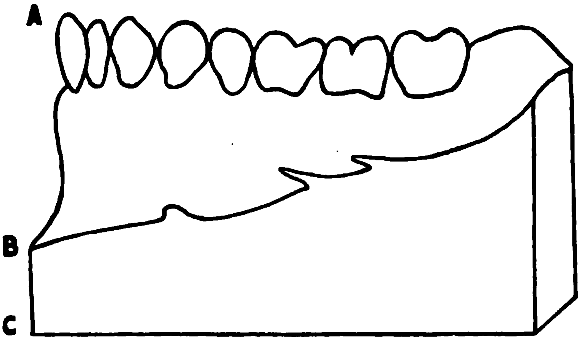

Fig. 156.

A to C represents height of model: A to B, the anatomical part of model; C to B equals one-third of distance from A to B; A to B equals three-fourths of height of model.

In order to properly trim the art portion of the model, it is necessary to have a small square, a pair of compasses, one or two sharp, strong knives (Fig. 187), and a plaster plane (Fig. 158). The plane will be found very difficult to manipulate at first but when used properly it gives a finish that can be obtained in no other way.

After the base has been trimmed and finished with the plane, a measurement is taken from the median line to a point distal to the molars (Fig. 159). This point distal to the molars establishes the distal portion of the

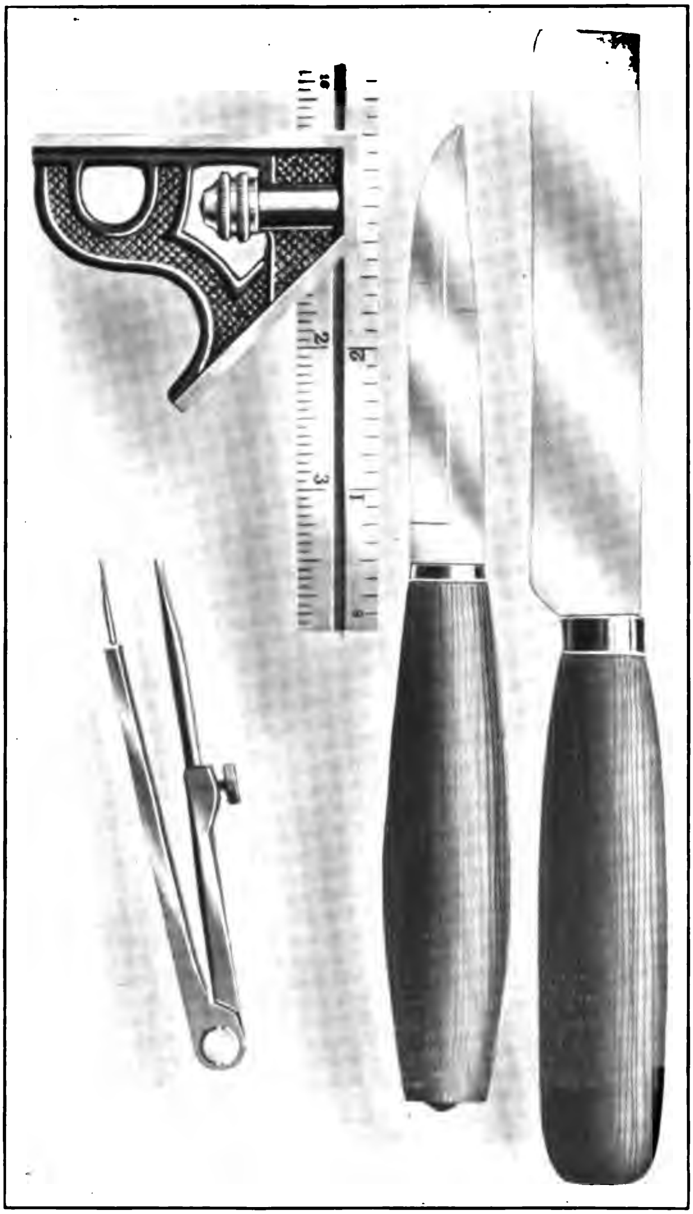

Fig. 157. A group of instruments used in trimming the model.

art part of the model. It is trimmed straight across and at right angles to the base (Fig. 160). The sides

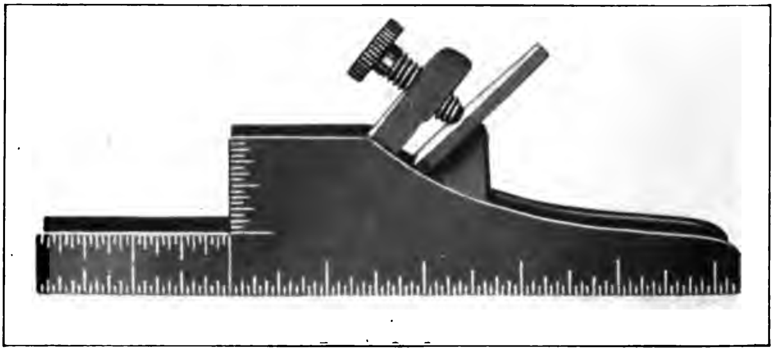

Fig. 158.
Plaster plane, used in trimming the model.

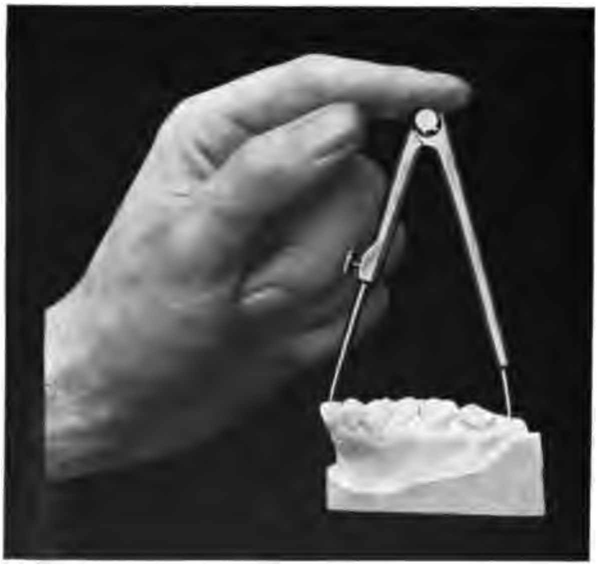

Fig. 159.
Taking measurement from the median line to a point distal to the molars.

are then trimmed and form a straight line parallel with the lines of occlusion from the molars to the canine, being trimmed only close enough to the anatomy to get all of the overhanging edges (Fig. 161). Care must

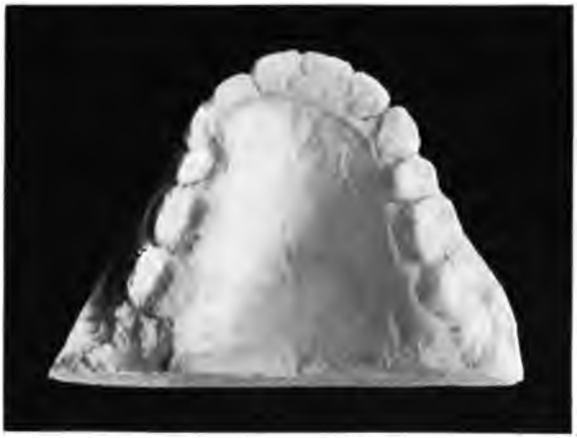

Fig. 160.
Model with base and back trimmed. Back must be at right angles to base.

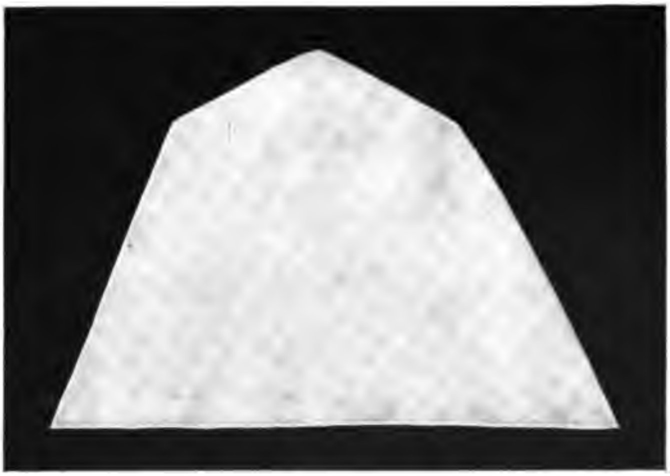

Fig. 161.
Sides trimmed at right angles to base.

be taken to hold the knife at right angles to the base, for the side must be trimmed at right angles to the base. Very often the sides are trimmed so close to the anatomical part as to ruin some of the anatomy and greatly mar the beauty of the model. The anterior portion of the model is now trimmed. A mark is made on the side in the region of the canine to represent the corners, as shown in Fig. 162. After these corners are

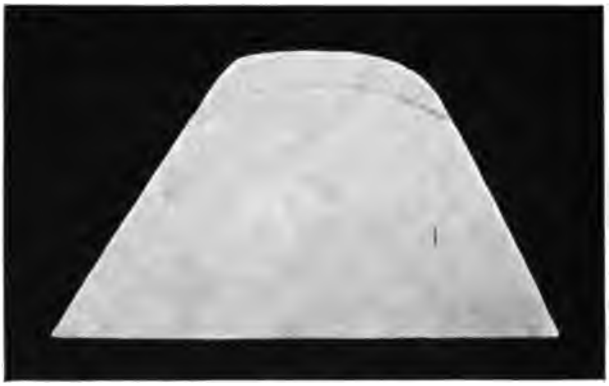

Fig. 162.
Appearance of base of model after the anterior corners have been established and the front marked with compasses.

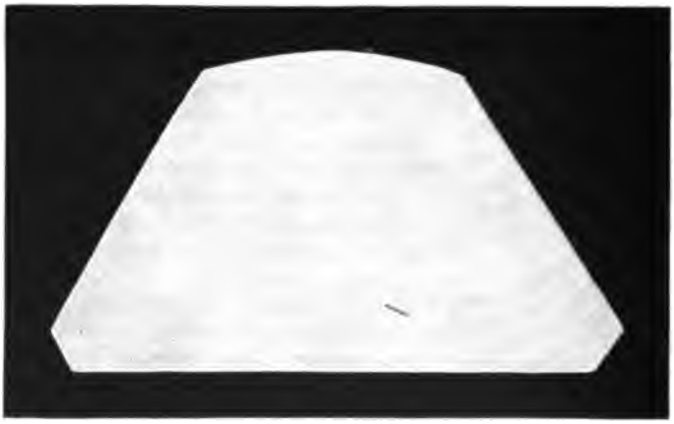

Fig. 163.
Distal corners of model trimmed at right angles to mesial corners.

established, the compasses are placed on each mark and the distance between the two points represents the radius of a circle. The anterior portion of the lower model is then trimmed to represent the arc of a circle, the radius of which is the distance from one canine point to the other. Then the distal corners of the model are trimmed at right angles to a line passing from the canine point to the opposite distal point (Fig. 163). The

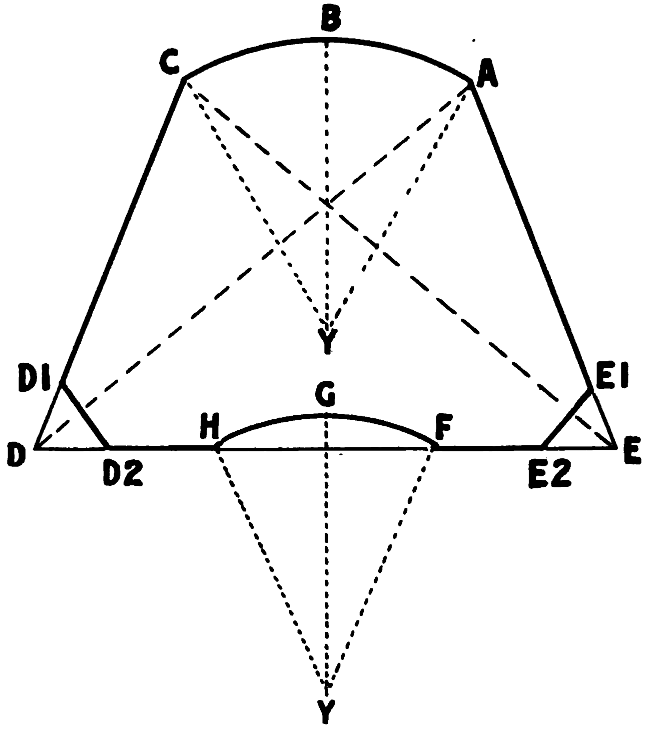

Fig. 164.

A, B, C are points on the arc of circle, the radius of which is the distance from A to C. F, G, H are points on circle, the radius of which is the distance from A to C. E1 to E2 and D1 to D2 are trimmed at right angles to lines running from C to E and A to D, which are one-fourth of distance A, B, C. The arc H, G, F is centrally located between D2 and E2. The different parts of the model should be trimmed in the following order: (1) The base; (2) The back from D to E; (3) The sides A to E and C to D; (4) The front A, B, C; (5) The corners D1, D2 and E1, E2; (6) The arc F, G, H.

distal corners are trimmed so as to be one-fourth the length of the arc of the circle that forms the front of the art portion of the lower model (Fig. 164). The distal portion of the base of model is divided into fourths,

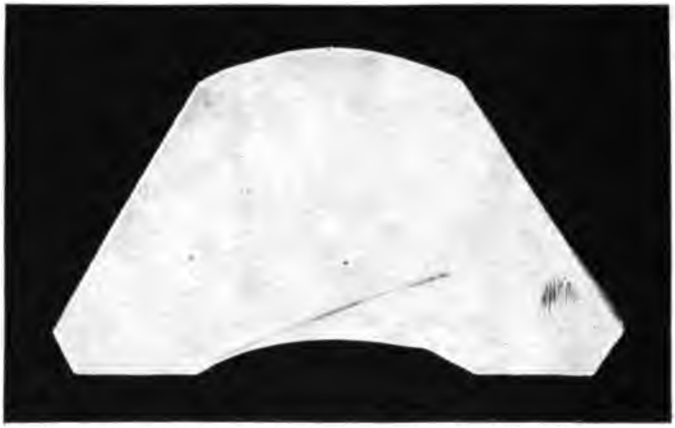

Fig. 165.
Base of completed lower model. Front trimmed round.

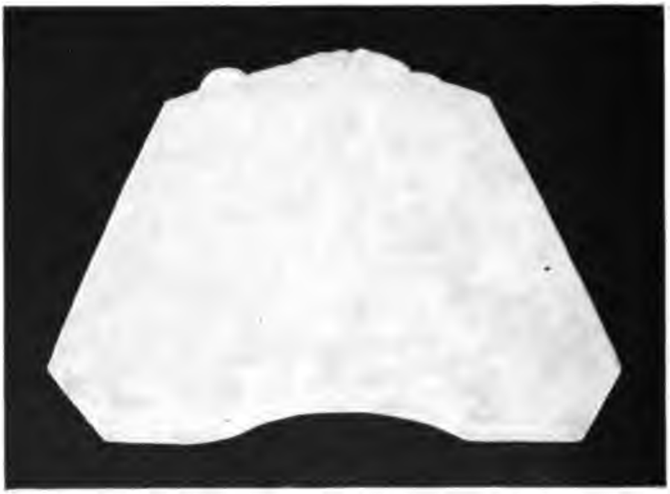

Fig. 166.
Base of completed upper model. Front trimmed to a point.

and two-fourths are used in making a curve as shown in Figs. 164, 165. This distal curve represents the arc of the circle, the radius of which is the distance from one canine point to the other. The curve in the front and the curve in the back are then arcs of circles which have the same radius. The base of the model then appears as shown in Figs. 164, 165. Fig. 166 illustrates the base of an upper model, which is trimmed as follows: The anatomical portion is measured in the same manner as described above, and the height of the art portion established in the region of the median line. The anatomical and art portions of the upper model

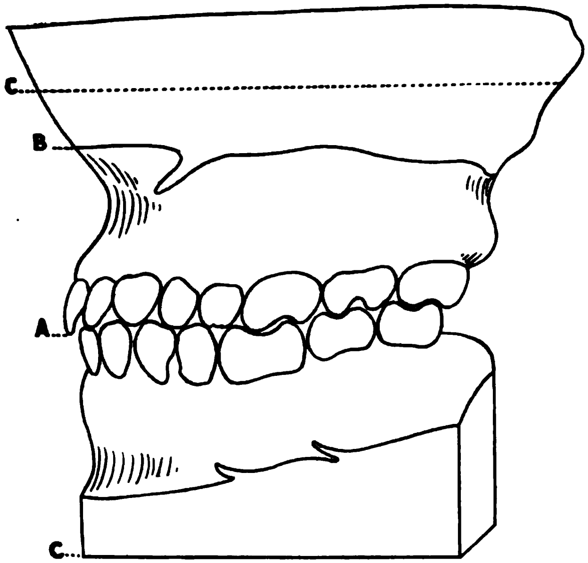

Fig. 167.

Method of obtaining the measurements for the anatomical and art portions of the upper model. Measure the anatomical portion of upper model, which is three-fourths of height of completed model. Then add one-third of distance from A to B, set square and make mark at C. Place upper model on lower model and measure from C on upper to C on lower, with teeth in occlusion. Make a scratch all around upper model with square, as shown by dotted line.

are obtained as shown in Fig. 167. Upon the upper model a line is circumscribed around its entire circumference, and the base is then trimmed. The distal line and sides are obtained in the same manner as in the lower model. The canine points are then fixed but the front of the upper model is made pointed, as shown in Fig. 167. The anterior angle is a point on the arc of a circle, the radius of which is the distance between the canine points. The distal corners are trimmed the same as they were in the lower, except they are made one-third of the length of the line from the canine point to the center of the model. The distal curve is obtained in the same manner.

Models when trimmed this way are well balanced, and if care has been exercised all through the procedure, there is no necessity to apologize for their appearance.

CHAPTER IX.

TREATMENT OF CASES.

Class I.

Cases of Class I present many different features. They resemble each other in having a normal mesio-distal relation of the arches. In other respects they may differ a great deal, as shown by the different types which were described under classification.

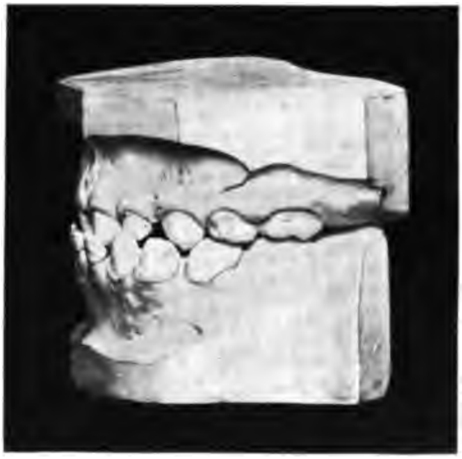

Fig. 168.
Class I case. Lingual occlusion of upper incisors to lower.

Taking up the treatment of the simpler malocclusions of this class first, we will consider the treatment of such cases as are shown in Fig. 168. In this case, the arches are in normal mesio-distal relation. The upper incisors are in lingual relation to the lowers. In fact, the upper teeth are lingual to their proper position and the lower incisors are labial. The patient is five and one-half years old. If the malocclusion is not corrected, it is certain that the permanent teeth will take the same position as shown by the deciduous teeth. The demand for treatment at this age is obvious. If this condition was allowed to exist until the eruption of the perma-

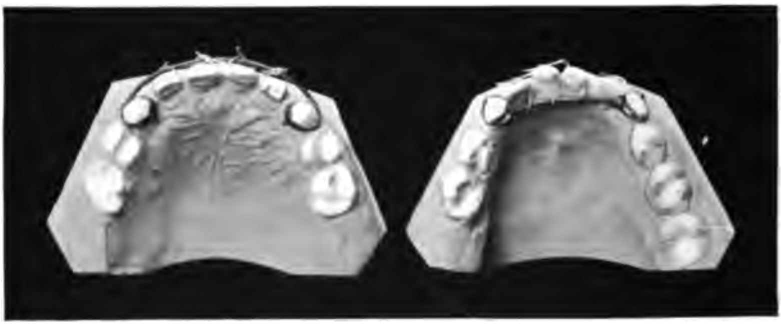

Fig. 169.
Appliance for moving upper incisors labially and lower incisors lingually

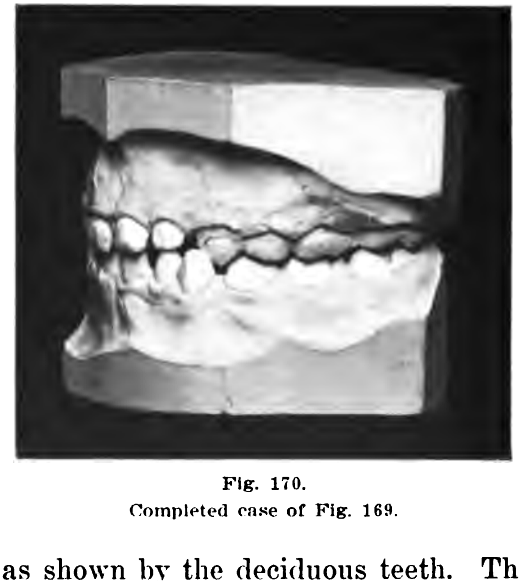

Fig. 170.
Completed case of Fig. 169.

nent teeth, the malocclusion would probably develop into a Class III case.

Plain bands, made as described in Chapter VI, were placed on the upper and lower canines. On the upper

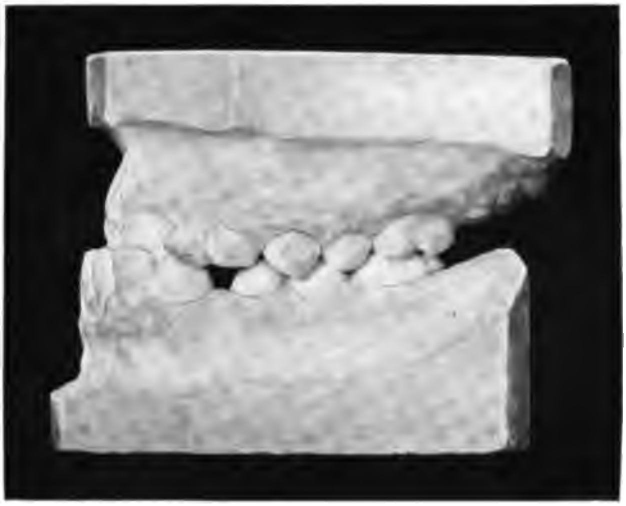

Fig. 171-A.

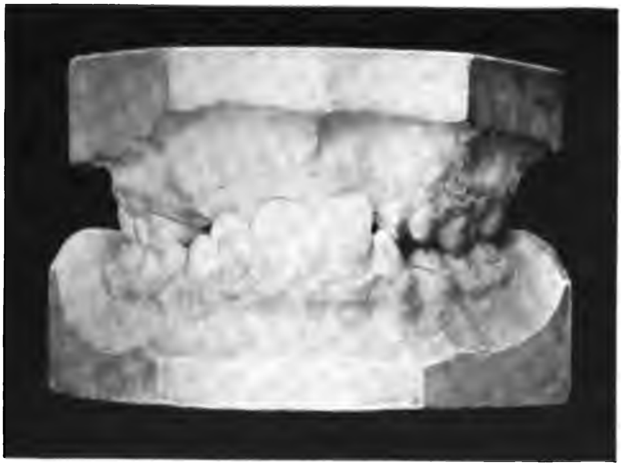

Fig. 171-B.
Side and front views of Class I case.

bands, a wire was soldered on the labial side, far enough labial to permit the incisors to be brought labially to their proper position. On the lingual side of the lower canines was soldered a wire, far enough lingual to permit the lower teeth to be moved lingually. The appliances are shown in Fig. 169. The upper and lower teeth were tied to the respective appliances by silk ligatures which exerted force on the teeth. In a few weeks the teeth were in the position shown in Fig. 170, and were retained for a short time by fastening them to the appliance by means of wire ligatures, which exerted a passive force.

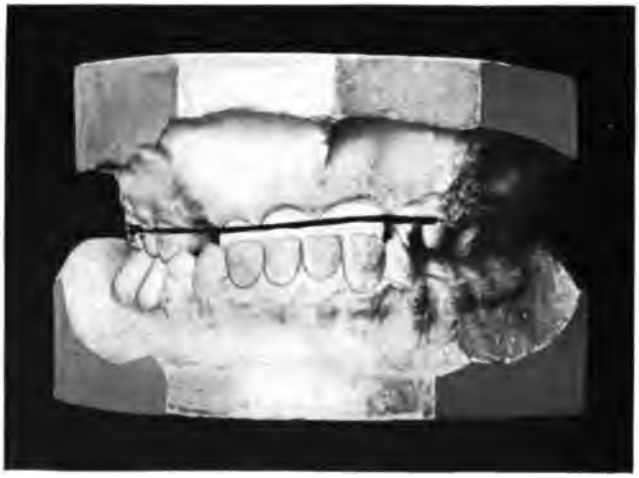

Fig. 171-C.
Black line indicates position expansion arch should occupy to the upper teeth and gingival margin.

Fig. 171 shows a case of Class I, the upper central incisors and right lateral incisor being in lingual occlusion. The left lateral incisor is in torsi-occlusion. The lower incisors are slightly in labial occlusion. A space exists between the lower left lateral and canine which shows the distance the lower anterior teeth are mesial. After studying the case carefully, the author came to the conclusion that the position of the lower

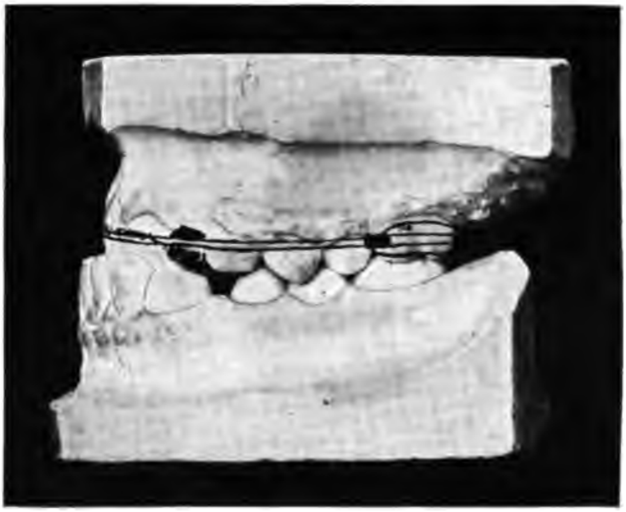

Fig. 172-A.

Side view showing position of arch in premolar region. Band on left canine to rotate same.

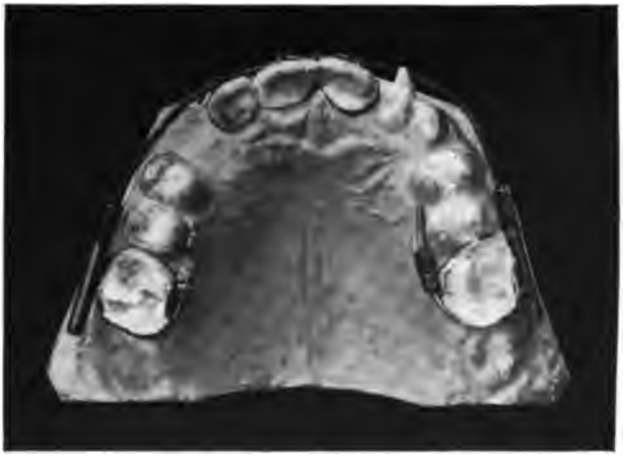

Fig. 172-B.

Occlusal view of arch. Band was used on left lateral, but is not shown.

teeth was the result of the malocclusion with the upper and if the upper incisors were moved labial to the lower, the force of the upper teeth against the lower teeth would force the lower incisors lingually to their proper position.

The upper teeth were treated by placing molar bands, as shown in Fig. 109, on the first molars. The screw was so placed that it occupied the position shown in Fig. 172, which also shows the position of the tube on the molar band. The arch was bent and adjusted so as to stand away from the anterior teeth, as they are the only ones which have to be moved. On the upper left lateral incisor, a plain band was placed with a spur soldered near the disto-gingival-lingual angle. The position of the arch is shown in Fig. 172. Wire ligatures were then placed on the upper anterior teeth and twisted tight. At first the greatest force was placed on the cen-

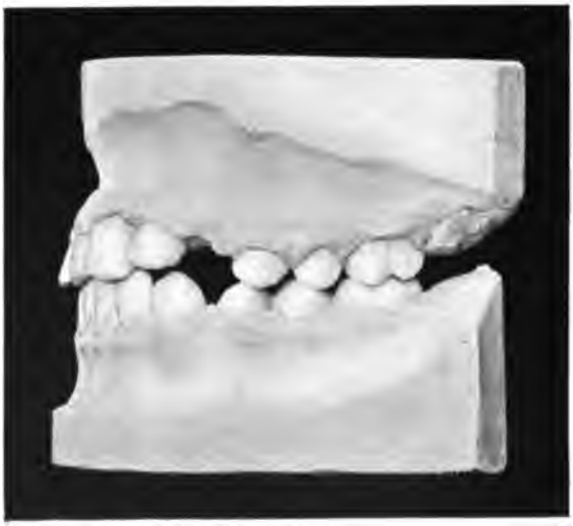

Fig. 173.

tral incisors so as to avoid too much pressure on the molars. After the central incisors started to move, force was placed on the lateral incisors. After the teeth had started to move, the three incisors, which are not rotated, were carried labially by tightening the nuts on the expansion arch; that is, by screwing the nuts distally. The wire ligature on the left lateral incisor was tightened at each visit so as to correct the torsi-occlusion of the lateral, on which was placed a plain band with a spur. After the upper teeth were moved into the position shown in Fig. 173, the teeth were retained by passive retention, as shown in Fig. 174. The retaining appliance was worn until the upper canine erupted, for it was necessary to retain the space for the permanent canine as the deciduous canine was soon lost. The occlusion of the upper incisors with the lower teeth carried the lowers distally and closed the space between the lateral and canine, as shown in Fig. 175. This case was one belonging to the third type of Class I.

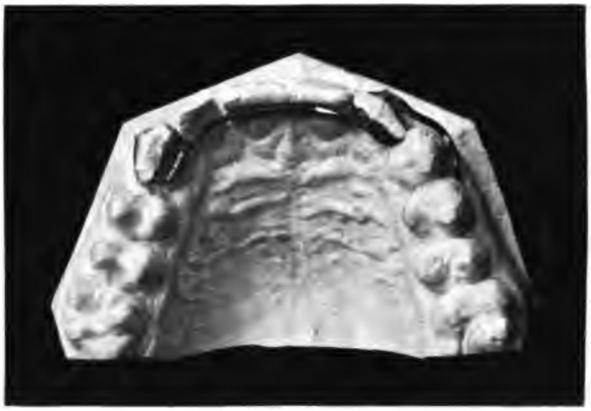

Fig. 174.
Showing retention of Fig. 171.

Fig. 176 shows another case of Class I which is typical of a great many cases belonging to this class and is

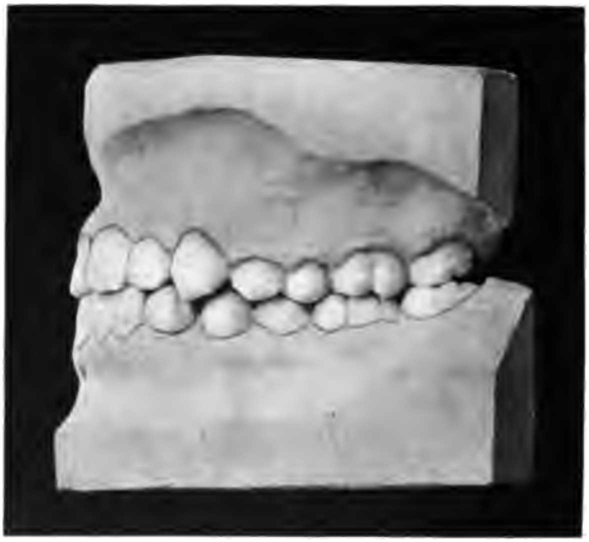

Fig. 175.

Completed case of Fig. 171. Note how occlusion has driven lower anterior teeth distally and closed space between canine and premolar.

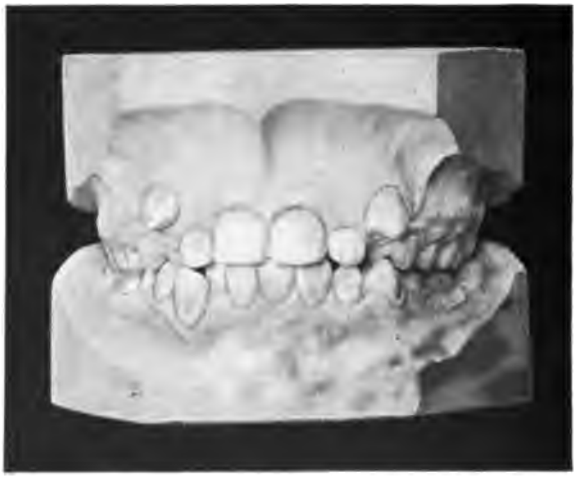

Fig. 176.

Class I case. Normal mesio-distal relation of arches.

one of the first type. In order to treat this case it will be necessary to expand both the upper and lower arch. The upper arch is underdeveloped about equally on both sides, and therefore the teeth will all have to be moved equally with the exception of the upper canines which

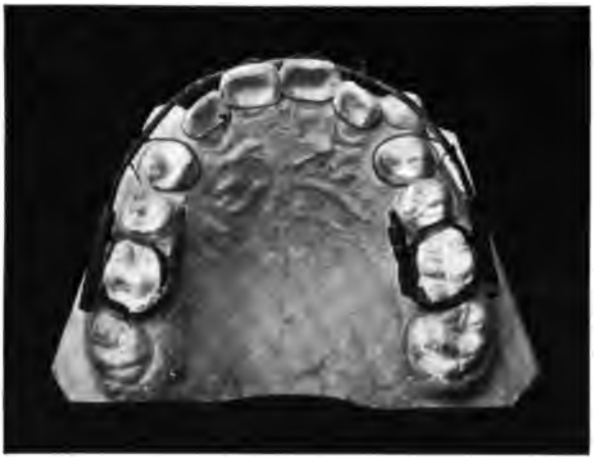

Fig. 177-A.

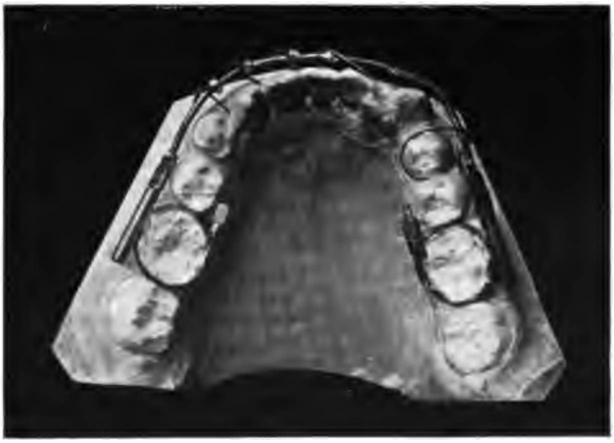

Fig. 177-B.

Occlusal view of appliances. Spurs on lower arch to move teeth toward left side.

will have to be depressed slightly. The front view (Fig. 176) shows that the median line of the upper and lower incisors is not a straight line. This is caused by the fact that the lower incisors have drifted to the right. The right lateral is distal to the canines and all of the lower incisors will have to be moved to the left.

Ligature wires are twisted between the teeth as described in Chapter VI, so as to produce enough separation to permit putting on the molar bands. Clamp bands are placed on the upper and lower first molars, as shown in Fig. 177. The upper arch is adjusted in such a manner that it stands away from the second premolars slightly and a little farther away from the first premolars. A bend is made in the canine region so that the arch lies below the tip of the canine. No effort is made to place the arch labially to the upper canines, for it would be too prominent and hold the lip out too much.

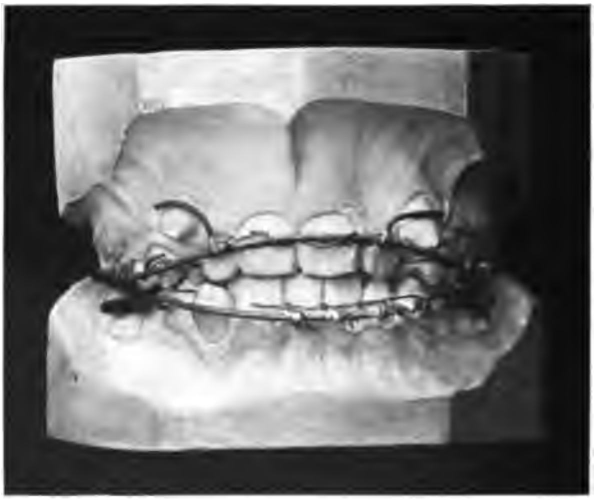

Fig. 178.
Front view, showing spurs to depress canines.

The arch stands labially to the incisors, as shown in Fig. 177. In order to exert force on the upper canines to depress them, tube-spurs are soldered to the arch, as shown in Fig. 178. These spurs are bent to fit the labial convexity of the canine and by bending the spur with a pair of pliers, force is exerted on the canines to depress them. This pressure can be increased by putting a rubber wedge between the canine and wire spur. The molar bands are placed on the lower first molars and the arches adjusted, as shown in Fig. 177, which also shows the shape of the lower arch. The lower arch is bent so as to assume a position labial to the lower right canine and bent with quite a sharp angle in the canine region. Owing to the fact that the lower incisor must be shifted to the left, soft solder wire spurs are placed on the arch at points shown in Fig. 178, and the ligatures placed so as to pull the teeth to the left. In order to increase the pull of the teeth toward the left side, the expansion arch is so adjusted that it stands away from the left canine region farther on the left side than it does on the right.

The upper teeth were retained by placing bands on the upper lateral incisors and the first molars. The first molar bands are plain bands. A lingual wire was placed on the lingual side of the teeth to retain the expansion of the arch. A spur was soldered on the labial side of the lateral incisor to make a downward pressure on the canine. The occlusal view of the retainer is shown in Fig. 179. The lower arch was retained by plain bands on the molars, left canine and right lateral. A lingual wire was used to retain the expansion of the teeth. A spur was soldered on the labial surface of the right lower lateral band to retain the canine. No band was placed on the lower right canine for it was in infraocclusion, and a band would have prevented it from

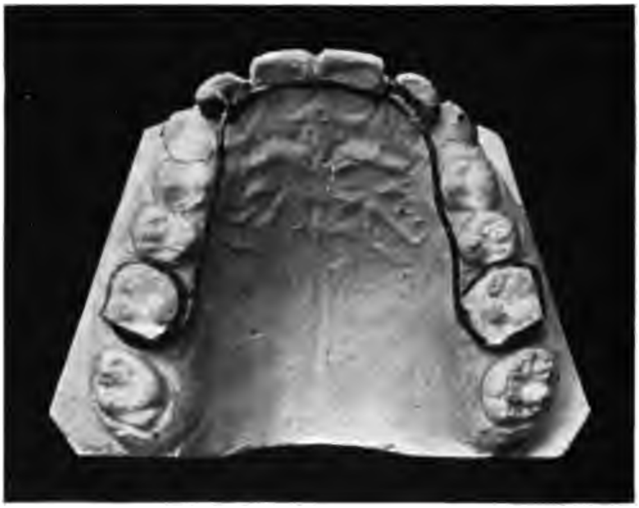

Fig. 179-A.

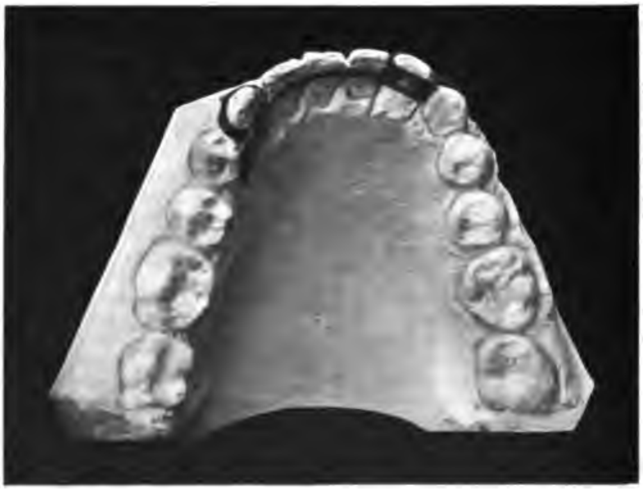

Fig. 179-B.
Occlusal view of retainers. Compound reciprocal intermaxillary retention.

elongating as it should. The front view of the retainer, which is a compound reciprocal retainer, is shown in Fig. 180.

Fig. 181 is a case of Class I in which there is bunching of the upper and lower teeth. The front view of the case shows that the median line of the upper and lower teeth is not in balance. The upper teeth have drifted to the right and the lower teeth to the left. The occlusal view (Fig. 182) shows the reason for the shifting of the median line. The position of the upper and lower canines is due to the early loss of the deciduous canines which permitted the upper anterior teeth to drift to the right and the lower anterior teeth to the left. When the lower left canine erupted, it forced the lateral incisor lingually and took a labial position. After separating the molar teeth, clamp bands were placed on both the upper and lower first molars. The arches were bent in the canine region to give the relations shown in Fig.

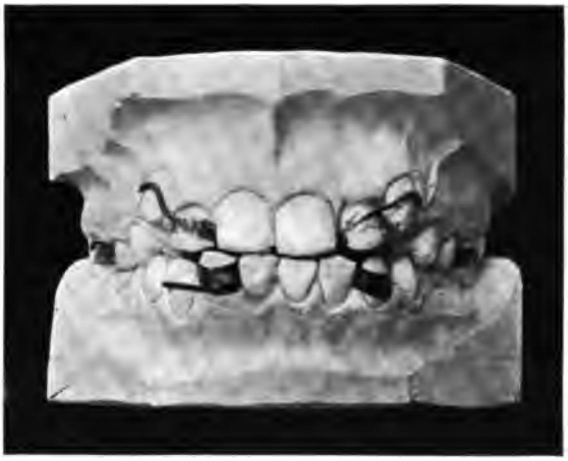

Fig. 180.
Front view of retaining appliance. Spurs to hold and move upper canines occlusally.

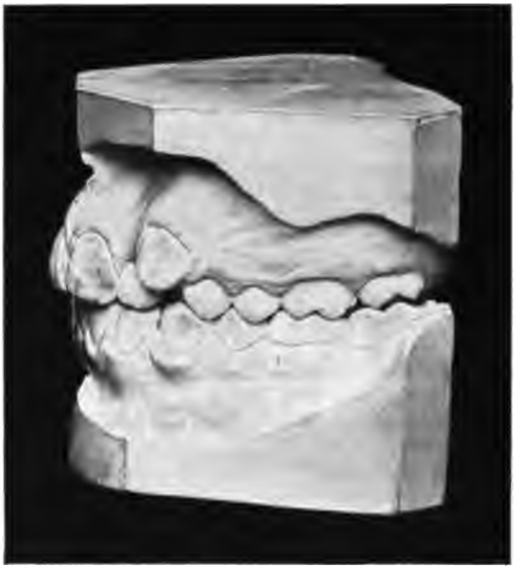

Fig. 181-A.

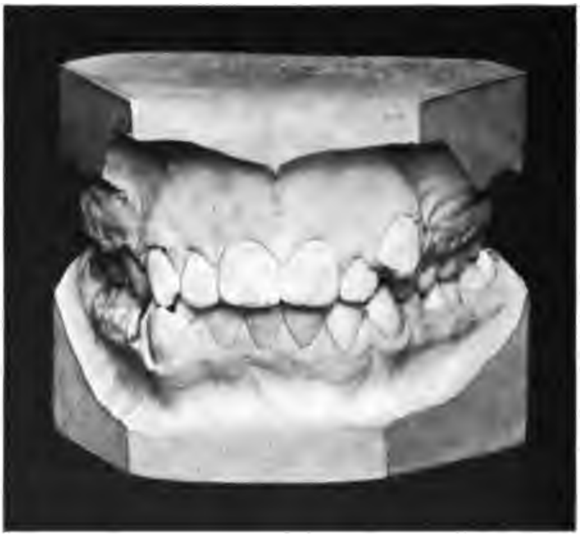

Fig. 181-B.
Class I case. Largely due to early loss of deciduous teeth.

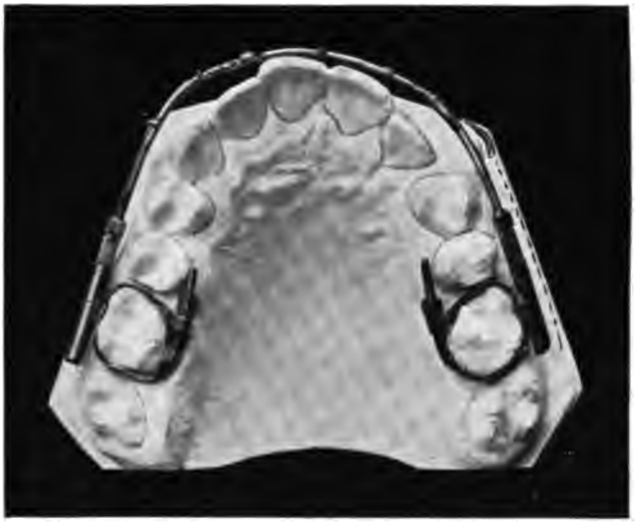

Fig. 182-A.

Occlusal view, showing spurs on arch and bend in arch on right side to move median line to the right. Dotted line shows position of arch before being placed in tube.

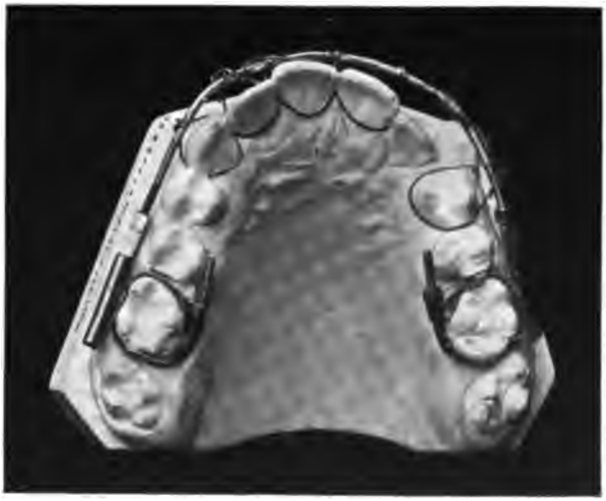

Fig. 182-B.

Shows how ligatures spring arch toward teeth. Dotted line represents position of arch before ligatures were placed on teeth.

182. Owing to the infra-occlusion of the right upper canine, it was necessary to place a tube spur on the arch, as shown in Fig. 183. It will be noticed that the spur is double, one portion of which projects gingivally and distally and rests on the labial surface of the canine and the other portion projects occlusally and distally and is used for intermaxillary anchorage. In adjusting the upper arch it is made to stand away from the canine and lateral on the left side, and spurs are soldered on the expansion arch in the positions shown in Fig. 183. When the ligatures are placed on the anterior teeth, the arch will be sprung as shown by the dotted lines. It will now be seen that the placing of the wire ligatures, as shown by the lines, has pulled the upper arch to the right side. No ligature should be placed on the left lateral incisor until the other three incisors have been moved to the right far enough to give room

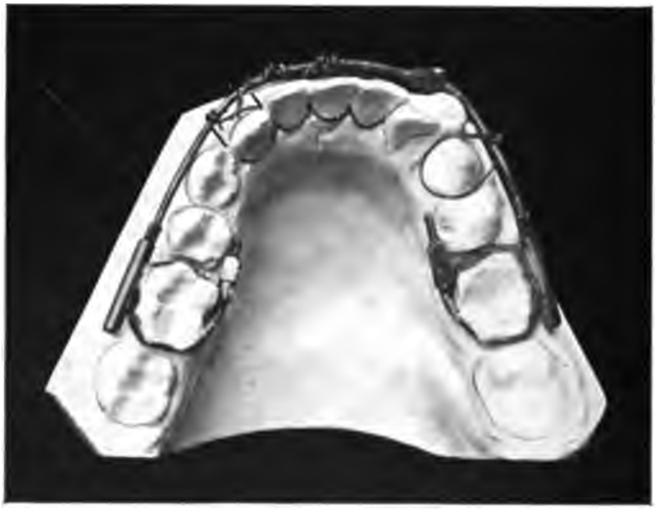

Fig. 182-C.

Shows relation of lower arch to teeth. Ligatures and spurs on lower arch to move teeth to left.

to bring it through. In applying the wire ligatures on the incisors, the right lateral should be ligated first as it is the one which receives the greatest stress; if the centrals were ligated first and the lateral last, it would be found that the ligatures on the central were loose after the lateral was ligated. After the three incisors have begun to move, a wire can be placed on the left lateral and the gingival portion of the tube-spur bent down on the canine.

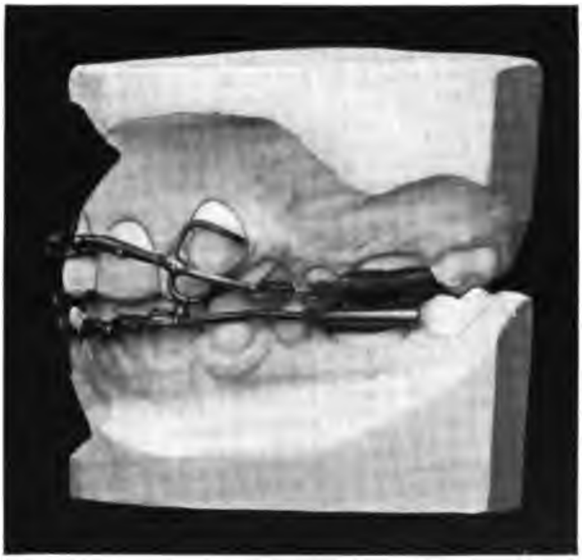

Fig. 183-A.

Double spur on upper arch. Gingival spur to depress canine. Occlusal spur to engage intermaxillary rubber, as shown in 183-B.

The lower expansion arch is applied the same as the upper arch except that the spring is reversed; that is, the right side of the arch takes its position away from the canine region and the spurs are soldered to the arch at the left side of the teeth which are to be moved. The position of the spurs can be seen by noting Figs. 182 and 183. On the right side of the lower arch is soldered a sheath-hook for the use of intermaxillary anchorage. The left canine, left lateral incisor and the centrals are ligated to the arch, which makes the arch assume the position shown by the dotted lines. From the sheath-hook on the lower arch to the sheath-hook on the upper arch, an intermaxillary rubber is stretched and worn at night, which assists in shifting the median line. This use of the intermaxillary anchorage was first described to the author by Angle.

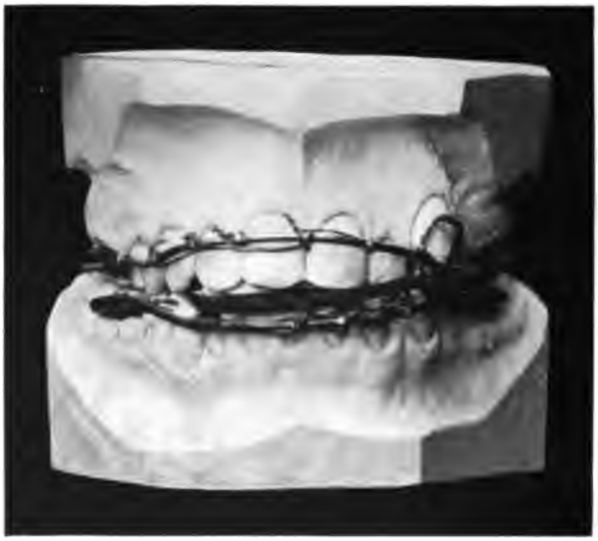

Fig. 183-B.
Intermaxillary rubber to assist in shifting median line of upper and lower arch.

As a result of the treatment the teeth were brought to their proper position and the median line of the upper and lower arches corrected, as shown in Fig. 184. The retention of the upper arch consisted of a plain band which was placed on the left lateral with a spur on the lingual side which engaged the lingual side of the left central, and a spur on the mesial side of the lateral band bearing against the labial surface of the canine, gingivally to the greatest convexity; so by bending the spur downward, pressure would be brought to bear on the canine which would cause it to assume the proper position in the arch, as it is now in infra-occlusion. Owing to the length of the cusps it was impossible for the upper arch to change unless the left canine and lateral slipped out of the line and the lower teeth changed.

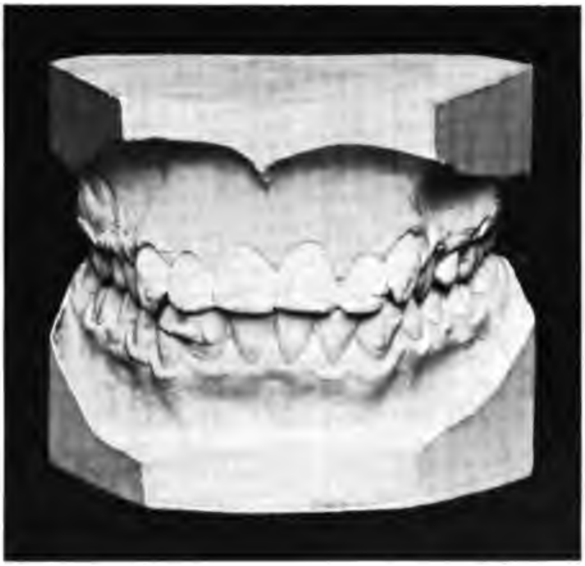

Fig. 184.
Completed case.

Therefore, it was important that the lower arch be retained in order to make the upper stay. Bands were placed on the lower canine and the right lateral incisor. A wire was placed lingually connecting the two. On the labial side of the lateral band was soldered a spur which engaged the labial surface of the right canine which had been moved from labial occlusion and was still in infra-

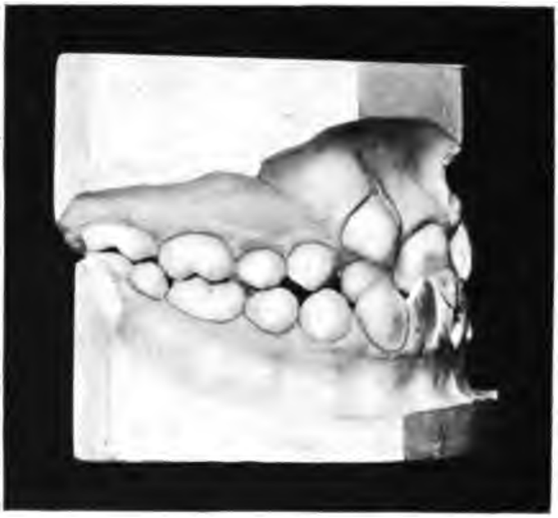

Fig. 185-A.

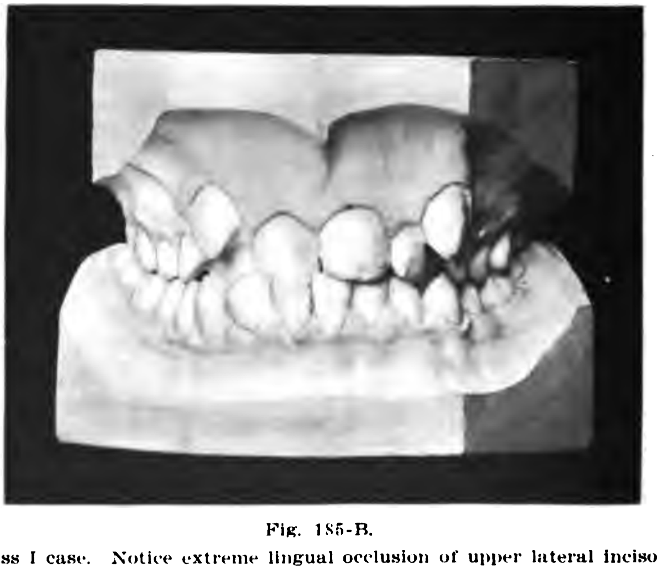

Fig. 185-B.
Class I case. Notice extreme lingual occlusion of upper lateral incisor.

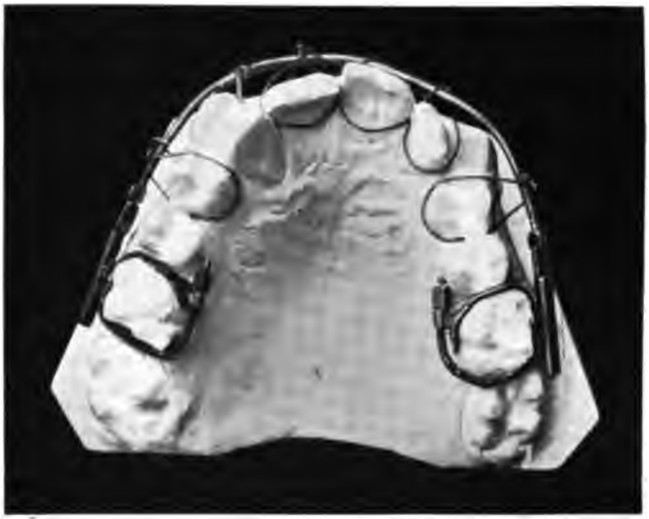

Fig. 186-A.
Upper appliance ligated to teeth.

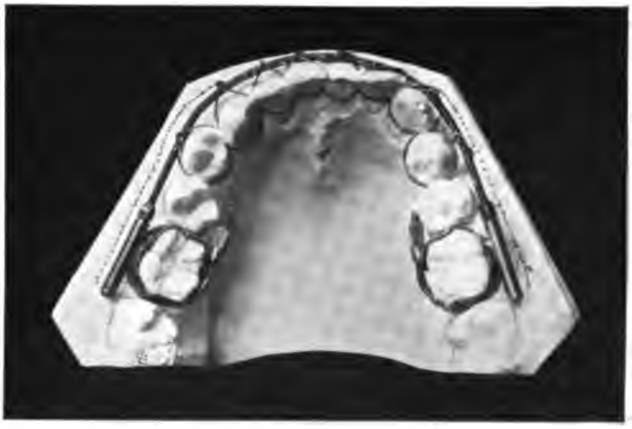

Fig. 186-B.
Dotted line on lower shows relation of heels of arch to tubes before arch is placed in molar bands.

occlusion. A band intended for use in compound retention should never be placed on a tooth which is in infra-occlusion, for it prevents the tooth from taking its proper position in the arch.

In removing the retaining appliances from a case of this kind, the upper should be removed first and the lower left a month or more longer. In any case, all of the retaining appliances should not be removed until all of the forces of occlusion have been established.

The right and front view of the case illustrated in Fig. 185 shows it to be one of Class I, as the arches are in normal mesio-distal relation. By looking at the right side and the front view it will be seen that the right lateral and central are in lingual occlusion. The occlusal view shows the right lateral in contact with the premolar. The entire upper arch needs to be expanded. Ligature wires are placed on the mesial and distal sides of the first molars and twisted to separate the teeth slightly so as to permit the placing of the molar bands. The molar bands were so placed that the tube lined buccally to the canine. While the canines are prominent, as the teeth now stand there is not sufficient room between them to accommodate the incisors. One side of the arch was placed in the tube on the molar band so as to obtain the proper length and alignment. The arch is allowed to stand away from the premolars and canine. In the region of the canine, the arch is bent at an angle as shown in Fig. 187. This bend is made in one side only, and the arch is only in one tube at this time. The position of the anterior portion of the arch to the anterior teeth is now noted, and the arch bent again in the region of the canine on the opposite side. The buccal portion of the arch is now aligned with the tube. Up to this time the arch has been placed in the tube only on one side. With the side of the arch in the tube which was first adjusted, the position of the other side is carefully noted. It should be observed how the angle of the arch compares with the angle of the tube before being placed in the tube. The arch should also stand buccally to the tube, for the molars require expanding and a slight amount of expansive force should now be given the arch. The arch can be made to stand buccally to the tube the width of a 16-gauge arch and will not exert enough expansive force to cause any pain. In adjusting the arch so as to produce expansion, the spring which produces the expansion must be derived from the anterior segment of the arch, and never from the heels or the distal corners, or the molars will rotate buccally. The position of the adjusted arch to the teeth is shown in Fig. 188. The positions of the ends of the arch to the tubes before they are placed in the tubes are shown by the dotted lines. Bands are placed on the laterals with spurs so they can be rotated and also to prevent the ligatures from slipping off. A spur is soldered on the arch at a point directly labial to the mesial surface of

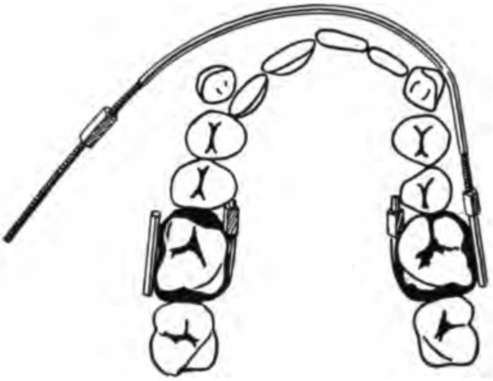

Fig. 187.
Showing method of adjusting arch by beginning at one side and carefully adjusting same until molar on opposite side is reached.

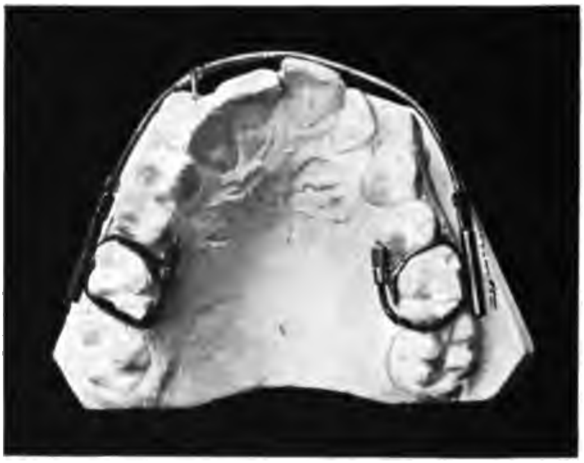

Fig. 188-A.

Plain bands with spurs were placed on the laterals, but are not shown on this model. Upper arch does not touch canines as those teeth must be expanded. Spur opposite right lateral is for bodily movement of same.

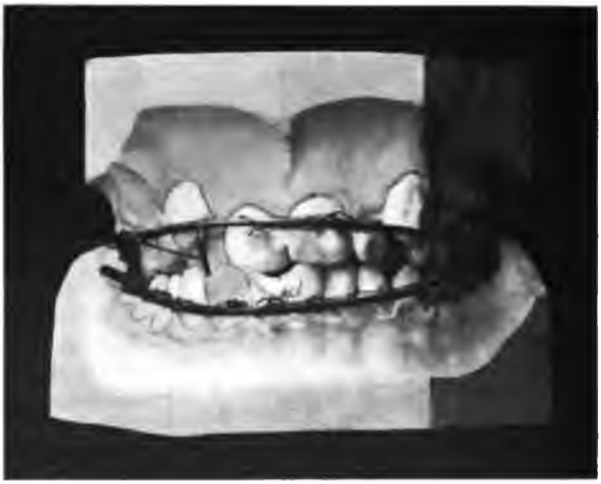

Fig. 188-B.

Front view of appliances. Right upper lateral incisor is ligated to arch after sufficient room has been made to allow it to move.

the right lateral, as the tooth must be moved directly labially in order to get past the canine. After the premolars have been expanded slightly and the incisors moved labially, it will be necessary to place a tube spur on the upper arch so as to move the apex of the right lateral forward. This spur rests against the incisal edge of the tooth which prevents that portion from moving and by tightening the ligature, the apex is brought forward. The position of the spur is shown in Figs. 188-A, 188-B, and 189.

There is nothing unusual or new in the adjusting of the lower arch as the teeth need expanding slightly. The left lower canine must be banded so as to permit it being rotated.

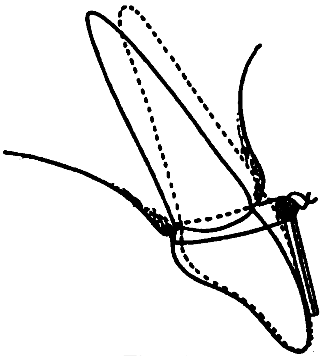

Fig. 189.

Cross-section of arch and spur for bodily movement of teeth shown in Figs. 188-A and 188-B.

The teeth of the upper and lower arch, having been expanded, are retained by compound reciprocal retention, so as to permit them to respond to the forces of occlusion. Bands are placed on the upper lateral incisors. A spur, long enough to engage the lingual surface of the central incisor, is soldered on the lingual side of each band. A long spur, extending back to the mesial portion of the upper first molar, is soldered on the labial surface of the lateral band. This long spur rests against the upper canine on the labial surface. Ligature wires, which have had a piece soldered to them as shown in Fig. 190, to prevent their slipping under the

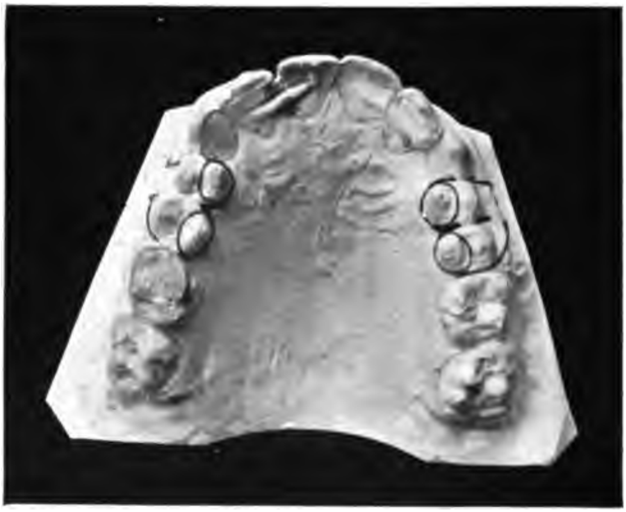

Fig. 190-A.

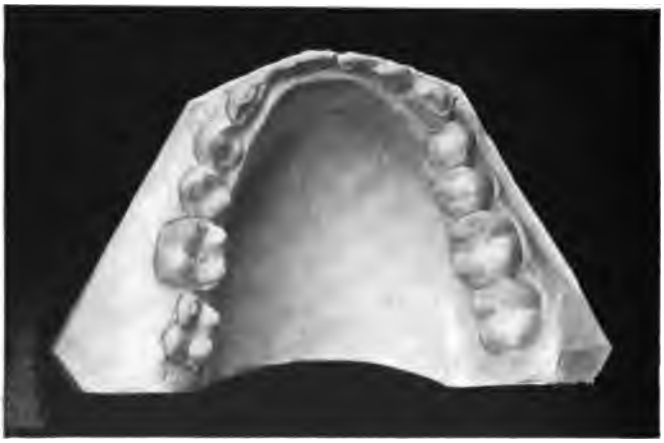

Fig. 190-B.
Impressions made after retaining appliances were placed on teeth.

gum, are placed on the first and second premolars. This plan of soldering a wire on the ligature wire to prevent it from slipping under the gum was suggested to the author by Lourie. After the premolars have been ligated to the labial spur we have the retaining appliance shown in Fig. 190. The advantage of this form of retainer is that none of the teeth are held rigid and by bending the spurs different amounts of force can be brought to bear on different teeth. The greatest tendency for the teeth to return to their former position is in the region of the first premolar, canine and lateral. This tendency is prevented by the construction of the retaining appliance, which has been so constructed as to make possible the highest degree of compound active reciprocal retention. The lower teeth were retained by the device shown in Fig. 190.

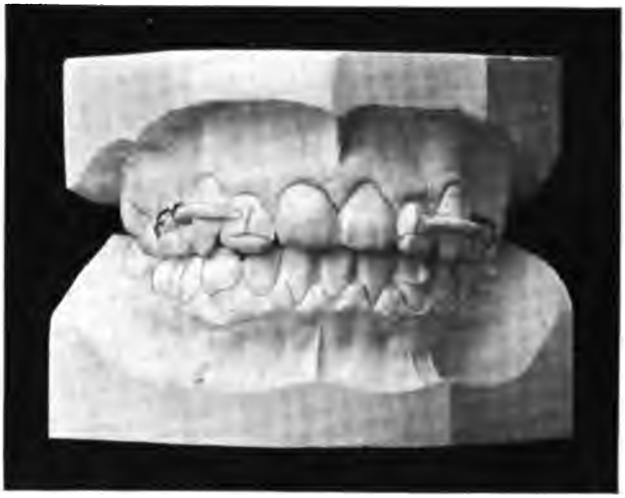

Fig. 190-C.
Front view, showing long labial spur over canine.

The case illustrated by Fig. 191 has a normal mesiodistal relation of the arches on both sides. The upper teeth on the right side, from the central and second molars, are in lingual occlusion, except the canine. This makes it necessary to expand or move the upper teeth on the right side farther than we will move the same teeth on the left side. It will therefore be impossible to use reciprocal anchorage, which has to a certain extent been employed in the former cases. In order to move the teeth which are in lingual occlusion to their proper position, we have the choice of several methods and anchorages. We can use reënforced simple anchorage, stationary anchorage, or intermaxillary anchorage.

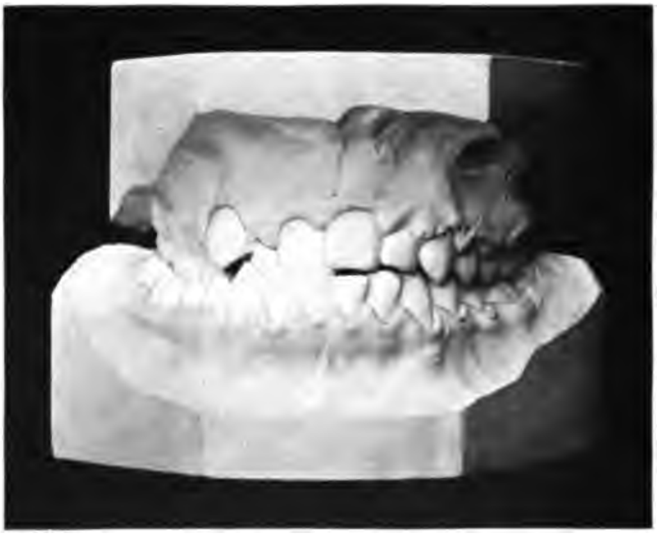

Fig. 191.
Class I case. Upper molars and premolars on right side in lingual occlusion to lowers.

In using reënforced simple anchorage, the molar bands are adjusted to the first molars in the usual manner. The arch is placed in the tubes on the molar bands with expansion in the molar regions. If nothing else was now done there would be an equal amount of force exerted on the molars of both sides, which is not desired. However, in order that the molar on the left side may have the advantage over the one on the right side, the screw on the left molar band is bent against the premolar, as in Figs. 192-A, 192-B, and away from the premolar on the right side. This enlists two teeth on the left

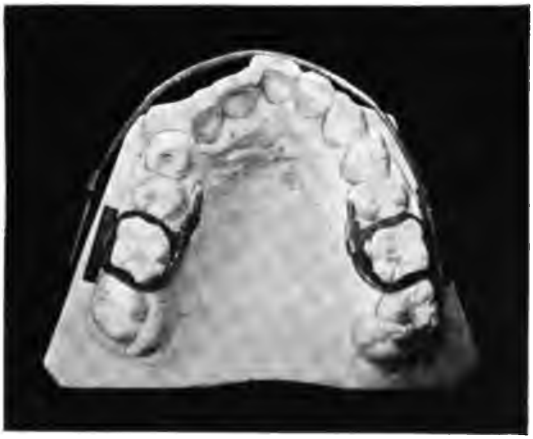

Fig. 192-A.
Showing arch before it is placed in tube.

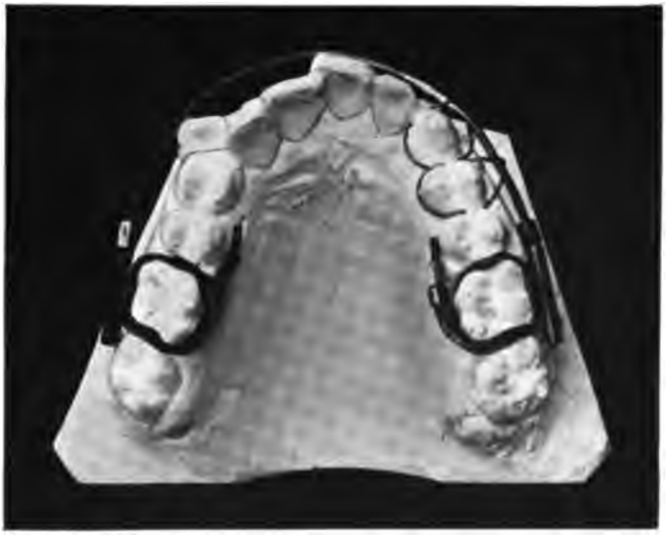

Fig. 192-B.
Showing arch after having been placed in tubes.

side against one on the right side. To further increase the anchorage on the left side, the first premolar and canine are ligated to the arch. This now makes reënforced simple anchorage, as a number of teeth on the left side are pitted against the tooth on the right side. Owing to the attachment of the peridental membrane and the alveolar process, it will be impossible to move the right first molar without exerting some force on the second molar and second premolar. In fact, when expanding the first molar in cases of this kind it is seldom necessary to attach to the second molar. In order to increase the buccal movement of the right molar, intermaxillary anchorage can be used by placing a rubber ligature from the screw on the lingual side of the right upper molar band to the tube on the right lower molar band. This will make the rubber occupy the relation shown in Fig. 192-D. If rubber ligatures of

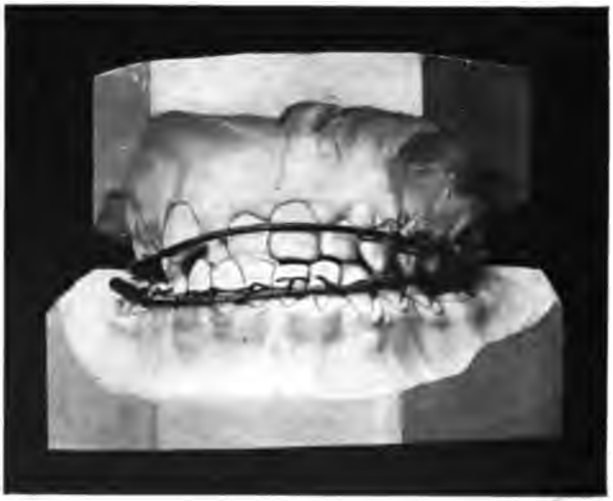

Fig. 192-C.
Front view of arches in position.

good quality are used, they will resist the stress of mastication remarkably well.

It has been stated that the molars and premolars on the right side could be moved by stationary anchorage. Stationary anchorage can be produced in several ways. One way is to use an oval tube; the arch is also oval which prevents the arch from turning in the tube (Fig. 192-E). This oval tube is used on the left side or the side which is to be made stationary. A square tube serving the same purpose has been devised by Kemple. If the oval or square tube cannot be obtained, stationary anchorage can be produced by the use of the ordinary round tube and expansion arch in the following man-

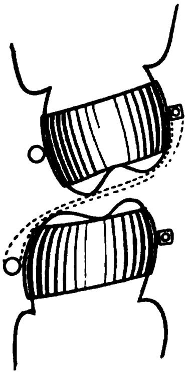

Fig. 192-D.

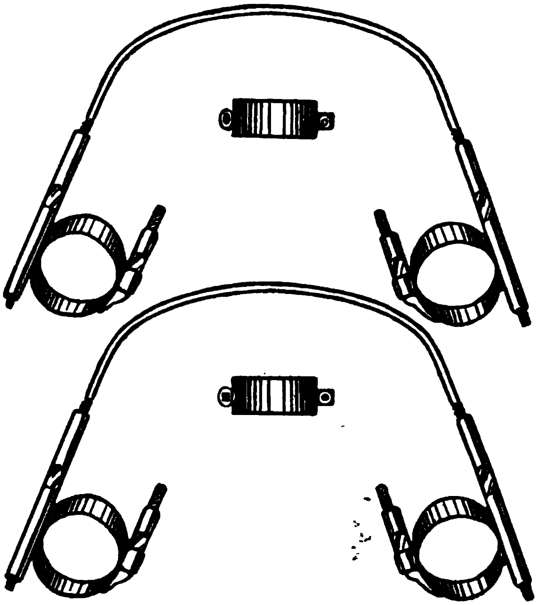

Fig. 192-E.

Fig. 192-D.—Rubber ligature from screw on lingual side of right upper molar band to tube on right lower molar band.

Fig. 192-E.—Showing oval and square tubes for stationary anchorage of molars.

ner: The arch is adjusted to the teeth and bent to align with the tube as it should. On the left side the tube is pinched to the arch by means of heavy pliers or a wire cutter. Then the nut on the band is loosened

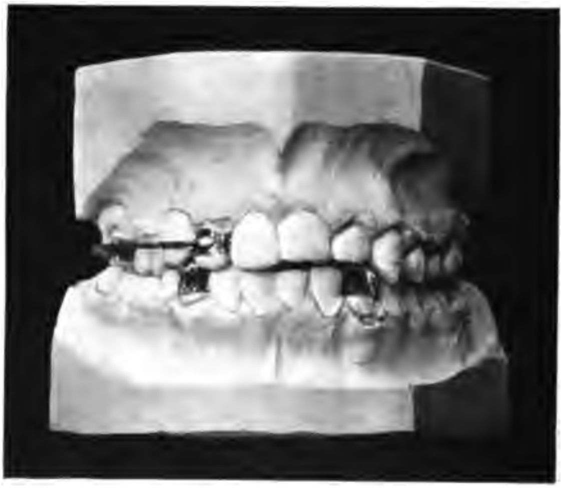

Fig. 192-F.

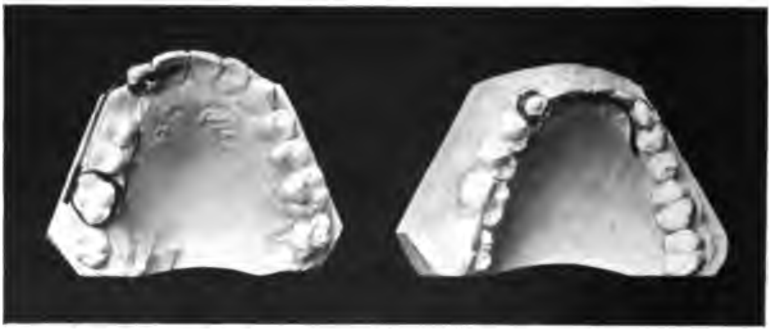

Fig. 192-G.
Front and occlusal view of Fig. 191, showing retention.

and the band removed with the arch in the tube. The tube is then soldered to the arch by means of soft solder. Soldering the arch in the tube makes the tipping of the left molar impossible unless the arch twists. The twisting of the arch must be taken into consideration in any of the forms of anchorage which we have mentioned. Care must be exercised so as not to strain the anchor tooth.

After the upper arch was expanded to the proper size, and the teeth on the right side brought to their proper position, they were retained on the upper teeth by the retention as shown in Figs. 192-F and 192-G.

There being nothing of particular interest in the lower arch, the treatment will not be considered here.

By looking at the right and left sides of the case shown in Fig. 193, it will be seen that on the right side there is a slight mesial tendency of the lower teeth, but they are not beyond the influence of the cusp, and the case is therefore classed as Class I. The left side shows a normal mesio-distal relation of the molars and the lower arch is short on that side owing to the early loss of the second deciduous molar, which has permitted the space intended for the second premolar to close. Looking at the front view of Fig. 193, and the left side of Fig. 193, it will be seen that the upper left incisor is in lingual occlusion to such an extent that it is lingual to the lower teeth. In order to get this tooth into its proper position, it is necessary to adjust the expansion arch in the same manner as described in other cases. The arch is adjusted so that it stands away from the teeth slightly, as a general expansion is needed. The premolars are ligated to the arch, as are the incisors. A spur should be soldered to the arch directly in front of the left central incisor so as to prevent the central from drifting to the left as it is carried forward. After the arch is expanded slightly and the anterior teeth carried forward, a ligature is placed on the left lateral and it is carried labially over the lower anterior teeth. It has often been suggested that a gag or some device be put on the teeth to open the bite while the teeth are being carried from lingual to normal occlusion. The author has never found this necessary in his practice. The lower arch will have to be expanded in all regions. In addition to that, it will be necessary to carry the left premolar, canine and incisors forward to make room for the impacted second premolar. The lower expansion arch is adjusted so as to exert force on all of the teeth

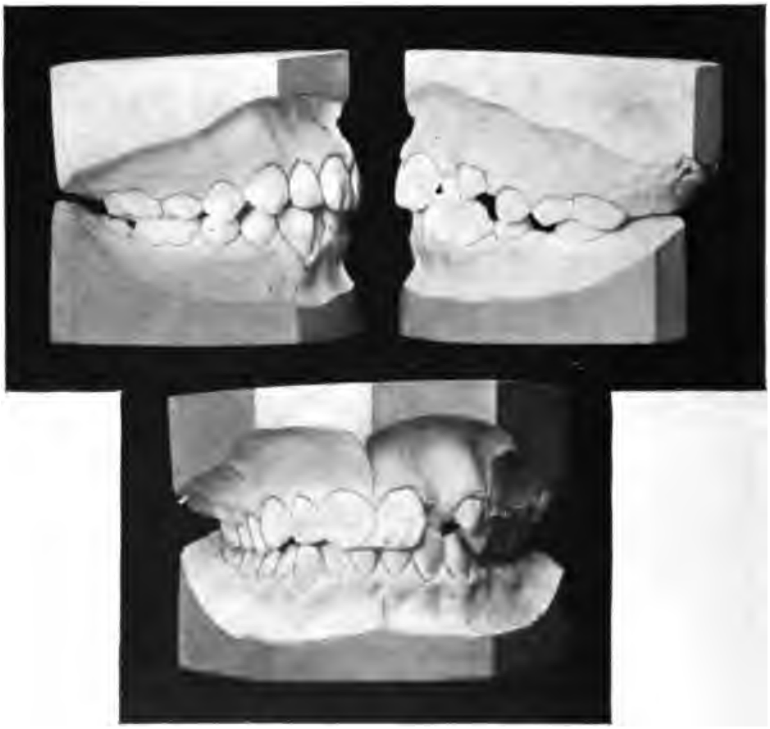

Fig. 193.

Class I case. Impacted lower left second premolar and upper left lateral incisor in lingual occlusion to lower.

to carry them buccally and labially. The relation of the expansion arch to the teeth is shown in Fig. 194. The expansion arch must be made wide in the canine region, as it is necessary to expand the dental arch a great deal in order to make room for the incisors. The canines are moved buccally before any attempt is made to bring the lower right lateral forward. The mesial movement of the left premolar and canine is accomplished by the use of a long wire ligature which engages the premolar and canine, and is twisted in front of a spur which has been soldered to the arch directly mesially to the canine. This spur is attached by soft solder and is made by twisting a ligature wire around the arch after the manner described in the making of spurs. Fig. 194 illustrates how this long ligature is placed on the arch. It will also be seen that there is another ligature on the canine, used for expansion. After this

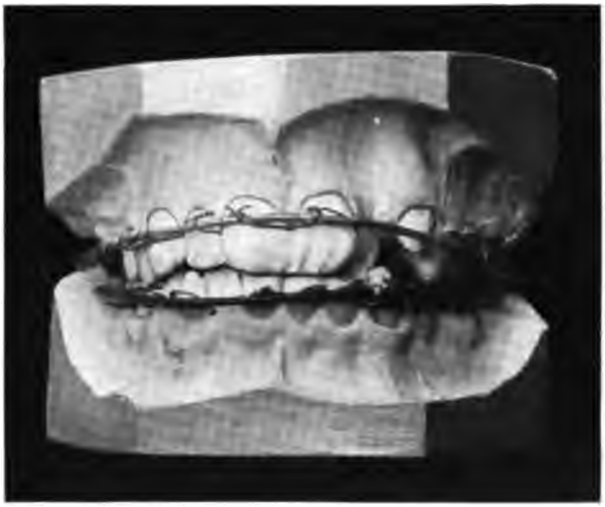

Fig. 194-A.
Front view, showing upper and lower arches.

long ligature is twisted tight around the premolar and canine, the teeth are carried forward by tightening the nut on the expansion arch. This gives the same movement to the teeth that would occur with a jack-screw. It must be remembered that as much force is being exerted upon the molar as upon the premolar, canine and anterior teeth. Very often the lower molar will be displaced distally, in which case it will be necessary to enlist intermaxillary anchorage in order to hold it in the proper position or to restore it to its normal position if it has been displaced. In this instance intermaxillary anchorage will be used by placing an intermaxillary-hook on the upper arch in the region of the upper canine, and adjusting a rubber from it to the distal portion of the tube on the lower molar band. Some have placed an intermaxillary-hook on the lower arch just in front of the nut on the left side and attached the rubber

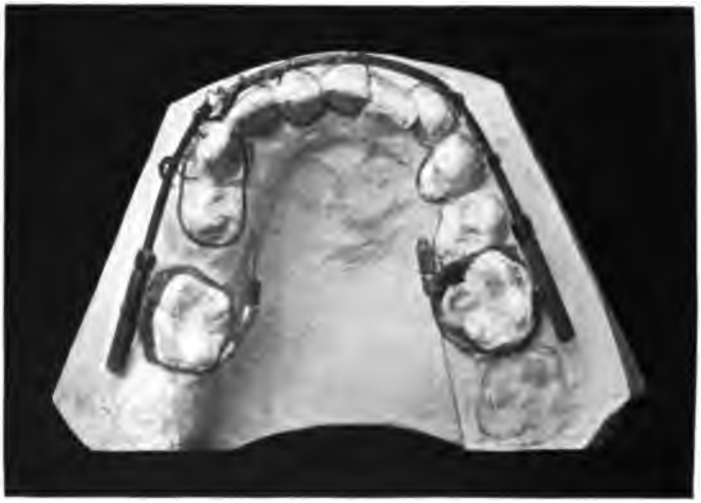

Fig. 194-B.
Spur and long ligature is shown on left side to move canine and premolar forward to make room for impacted second premolar.

from the hook fastened to the upper arch to the hook on the lower arch. This will avoid any forward pull upon the molar. Where the intermaxillary rubber is used from the upper hook to the distal portion of the lower band, the forward pull of the rubber is counteracted by the backward push of the nut on the expansion arch, and if these forces are kept balanced the molar will not move at all. Should the molar be moved distally before it is discovered that the anterior teeth are causing the molar to be displaced, a rubber is used that is strong enough to pull the molar and lower anterior teeth forward. The different attachments for this use of intermaxillary anchorage are shown in Fig. 195.

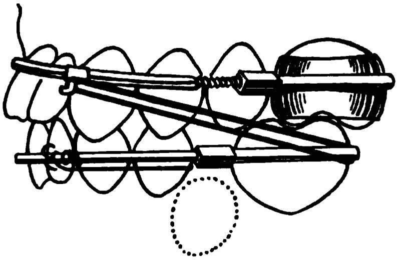

Fig. 195-A.

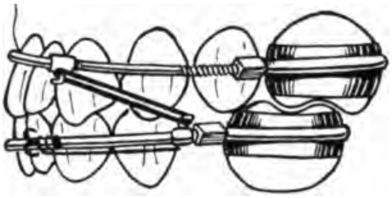

Fig. 195-B.

Fig. 195-A.—Intermaxillary rubber placed distal to molar tube to prevent molar from moving distally, as the nut on arch is screwed distally to carry anterior teeth forward to make room for impacted premolar.

Fig. 195-B.—Intermaxillary rubber placed on intermaxillary hook, which is mesial to nut on lower arch, for the purpose of moving lower teeth forward. No forward force is exerted on lower molar with this plan of attachment.

During the treatment of the case, the second left lower premolar came into position. The eruption of this tooth maintains the proper mesio-distal relation of the lower teeth on the left side (Fig. 196). The upper teeth were retained by placing a band on the upper lateral incisor with a spur on the labial side which embraced the central incisor and canine (Fig. 197). No other retainer was placed on the upper teeth, for with the long cusps it was impossible for the upper arch to narrow unless the lower one did so first. The lower arch was retained by placing bands on the lower canines and shaping a wire to fit the lingual surfaces of the lower teeth as far distally as the mesial portion of the lower molar. This lingual arch should be made of some material which possesses considerable spring. It is soldered to the lingual surface of the canine bands and occupies the position shown in Fig. 197. The narrowing of the lower molars is prevented by the spring of the lingual bar, and the pressure can be increased in a buccal direction by grasping the bar distal to the canine band with a pair of pliers and bending it outward.

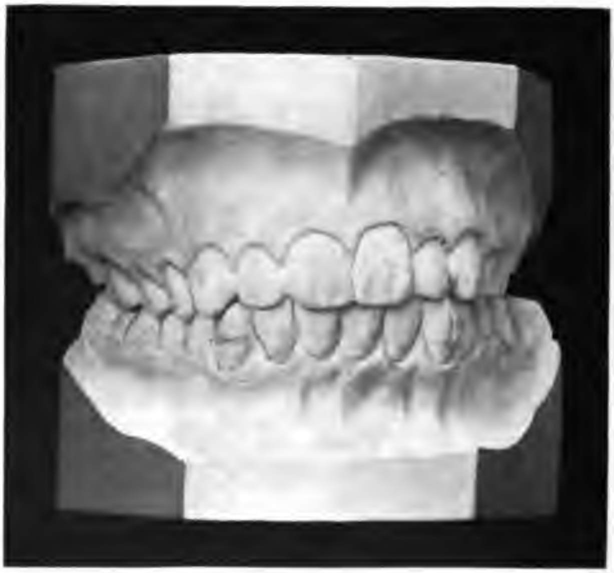

Fig. 196.
Front view of completed case shown in Fig. 193.

Mutilated Cases of Class I should be treated with a view of restoring normal occlusion as near as possible.

That means that some artificial substitute should be placed on the teeth which will take the place of the missing teeth or tooth. Considerable has been written on "Compromise Treatment" which means that, in those cases which have been mutilated, some method is followed which will improve the occlusion but will not tend to produce normal occlusion. The compromise

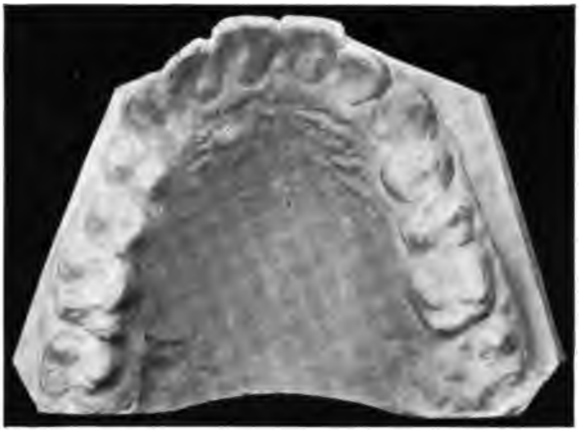

Fig. 197-A.
Upper impression was made before retaining appliance was placed on lateral.

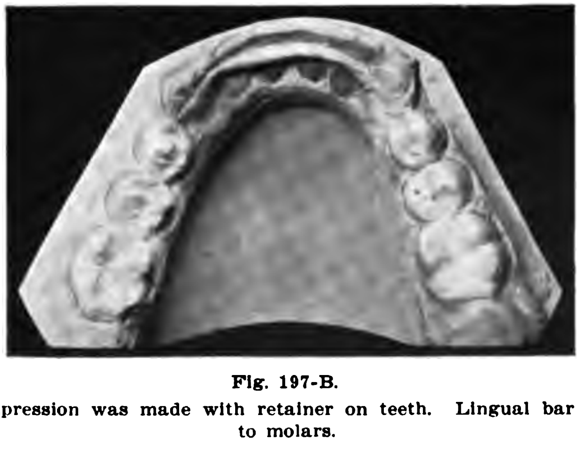

Fig. 197-B.
Lower impression was made with retainer on teeth. Lingual bar extended to molars.

method should only be attempted by the experienced orthodontist.

Fig. 198 shows a case which is complicated by extraction. The lower first and second molars and second premolars below were extracted. The third lower molars drifted slightly forward. Owing to the loss of the lower molars the lower anterior teeth drifted distally until the lower lip was caught under the upper anterior teeth and those teeth were forced forward. The general facial appearance of the patient would suggest Class II, but the mesio-distal relation of the arches shows it to be Class I. These cases become so extreme that they demand some sort of treatment, and it is to show that something can be done for these unfortunate patients that the author is describing this case. The lower anterior teeth occlude against the gums above, lingual

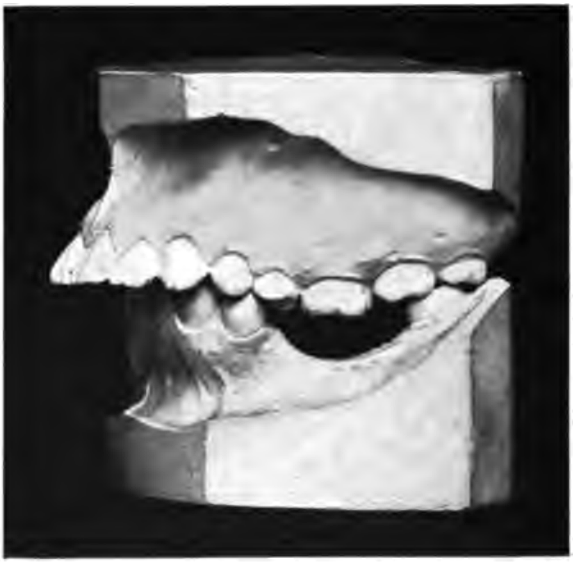

Fig. 198.
A mutilated case of Class I.

to the superior anterior teeth. This condition was causing the patient a great amount of irritation which could only be corrected by increasing the length of the molars and premolars.

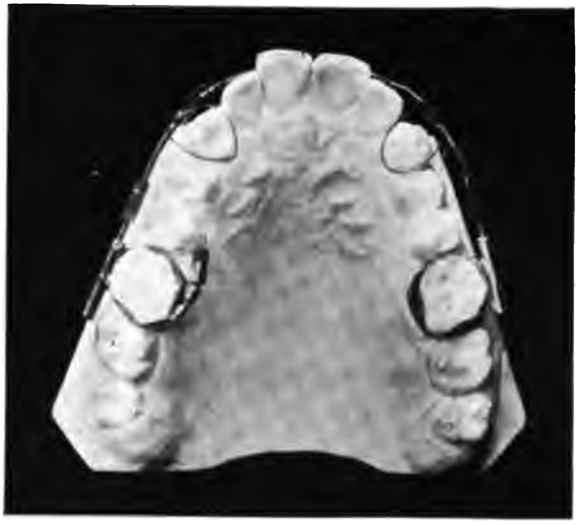

Fig. 199-A.
Showing upper appliance in place.

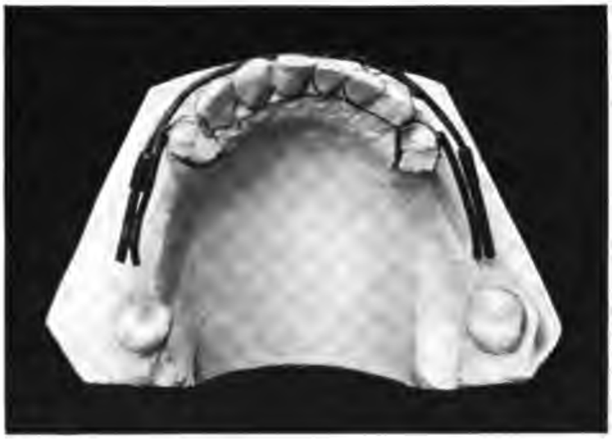

Fig. 199-B.
Showing lower appliance in place.

In treating this case, it was impossible to attach bands on the lower molars for they were too loose, so it became necessary to use the lower first premolars for anchorage. The position of the lower teeth makes it necessary to move all of the lower teeth forward and this was done by the use of intermaxillary anchorage. In order that there will not be much upward pull on the premolars, a bar is soldered to the premolar band as shown in Fig. 199, which extends backward as far as the position occupied by the lower first molar. A tube to support the end of the arch was soldered on this bar. The distal end of the band was bent lingually so as to form a "V," which engages the intermaxillary rubber. With this extension bar on the premolar, it is possible to use a regular size arch, which gives a greater range of spring and does not exert much upward pull on the premolars.

The upper expansion arch was adjusted so that the anterior portion rested against the upper anterior teeth, being buccal to the canines and premolars as shown in Fig. 199. The nuts on the upper arch did not touch the tube on the upper molar band, for all of the force of the rubber ligature was to be exerted against the incisors. Wire ligatures were placed on the premolars and canines so as to move them buccally.

The backward pull of the intermaxillary rubbers against the upper anterior teeth was also reciprocated against the lower teeth. As the upper incisors moved distally faster than the lower teeth moved forward, when the upper anterior teeth had been moved to their proper position, and the dental arch widened the proper width, the nuts on the upper expansion arch were allowed to rest against the bands on the upper molars, so that all of the upper teeth were pitted against all of the

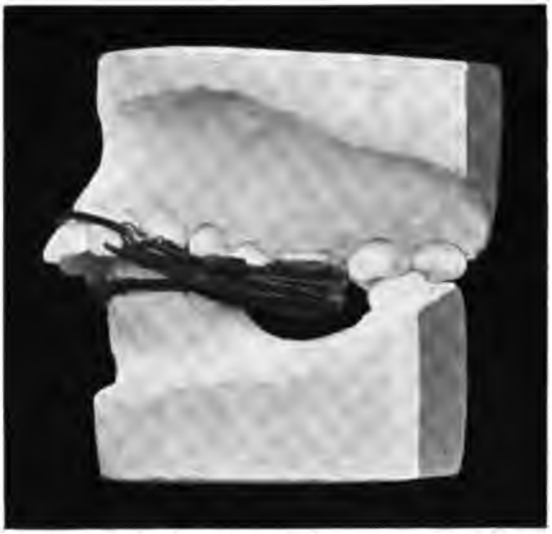

Fig. 200-A.
Side view, showing intermaxillary rubbers. Compound reciprocal intermaxillary anchorage. Note position of nuts on upper arch.

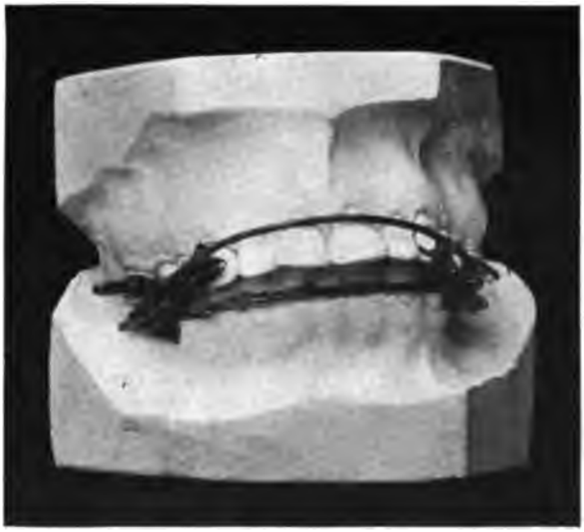

Fig. 200-B.
Front view, showing position of upper arch.

lower teeth (Fig. 200). The continued use of the intermaxillary rubbers finally moved the lower teeth to their proper position. It was then necessary to restore the missing teeth. In this case a gold plate was used. The improvement of the facial outline was very pleasing. The improvement in the occlusion of the teeth is shown in Fig. 201. Cases of this type are not attractive to some operators, and many practitioners go so far as to advise against treatment, but these unfortunate people have a right to some relief and, if properly handled, very satisfactory results can be obtained.

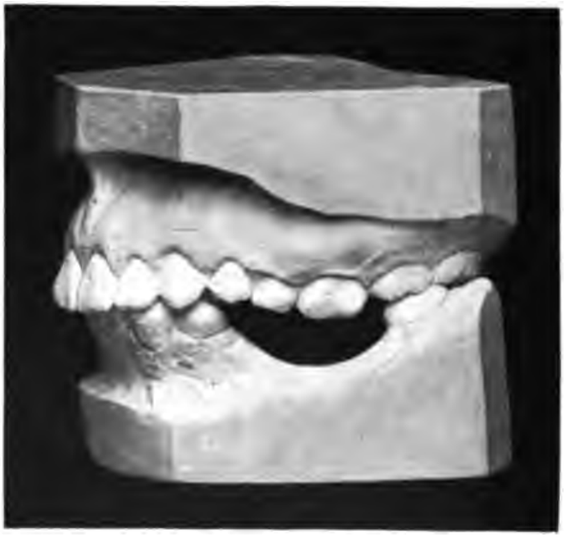

Fig. 201.
Completed result of case shown in Fig. 198.

The retention of the case consisted in placing an accurately-fitting gold plate in the lower, which carried properly occluded artificial teeth with proper mesiodistal contact. This plate retained the lower teeth in their proper position. No retaining appliance was put on the upper teeth, as it was impossible for them to change their position owing to the position of the lower lip and the force of the muscular pressure.

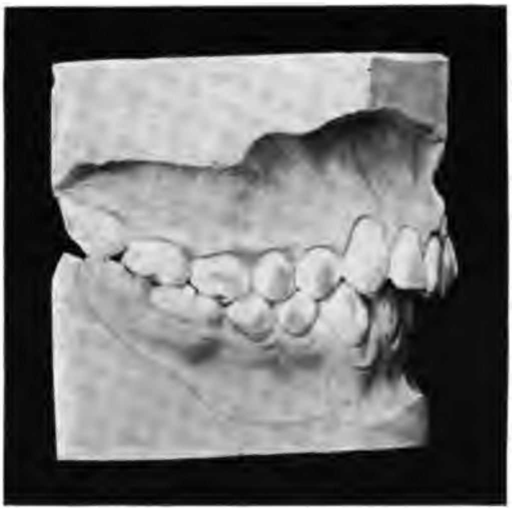

Fig. 202-A.

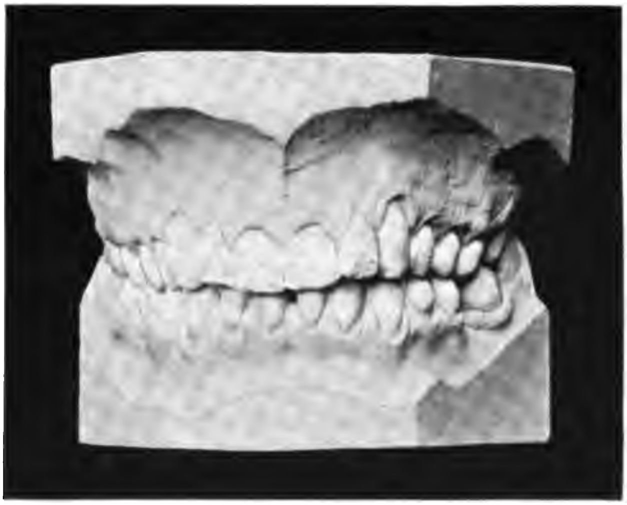

Fig. 202-B.
Front and side view of malocclusion caused by extraction of lower first molars.

A common form of Class I cases are those which are mutilated as the result of the extraction of the first molars. These patients often give a history of a normal occlusion prior to the time of the extraction of the first molars. The change is often gradual and they are not aware of the trouble that is resulting until it is brought to their attention. In the case shown in Fig. 202, which was caused by the early loss of the lower first molars, the teeth gradually drifted together until the lower second molars and the premolars were in contact on both sides. As a result of this drifting, none of the teeth are in normal occlusion. The lower incisors are biting against the upper gums and to remedy this condition the difficulty presented was to open the space for the missing teeth and supply an artificial substitute.

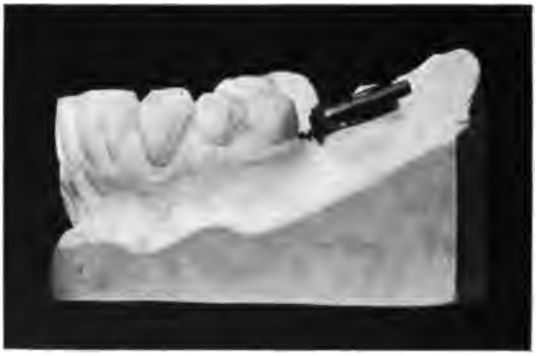

Fig. 203.
Position of tube on molar band, which must be resoldered so as to assume position shown in 204.

Very often, in these cases, it is only necessary to open the space far enough to supply a tooth half the size of the molar, as that is sufficient in some cases to open the bite far enough to prevent the lower teeth from striking the upper gums. However, it must be remembered that it is always necessary to move the lower anterior teeth, or rather the teeth anterior to the molars, into their proper position. If the proper space is not restored, it is because the second and third molars are not moved distally to their proper position, for the teeth anterior to them must always occupy the proper mesio-distal relation with the uppers.

In treating these cases, it is necessary to move the molars distally and the teeth anterior to them mesially. Clamp bands are placed on the second molars, and owing to the tipping of these teeth it is always necessary to solder the tube at a different angle from that which it occupies on the band as supplied by the manufacturers. Fig. 203 shows the tipping usually encountered in these cases, and plainly illustrates the position the tube assumes as the band is placed on the tooth. In Fig. 204 is shown the position to which the tube must be changed. In aligning the tube, the anterior portion of the tube should be so placed that the anterior portion of the arch rests apically to the gingival portion of the teeth, as shown in Fig. 205-A. This position of the arch

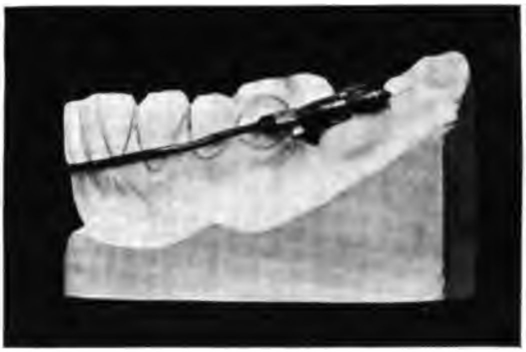

Fig. 204.
Position of arch, which is sprung up to tip molar backward.

is necessary to give a backward and upward tipping of the molar, produced by springing the arch occlusally and wiring the anterior portion of the arch to the anterior teeth. The effect of this action upon the molars is shown in Fig. 205-B. The side view of the appliance is shown in Fig. 206-A. Spurs are placed on the lower arch mesial to the canines for the purpose of using the long ligatures to bring the premolars and canines forward. The ligatures on the anterior teeth carry them forward as the nuts on the arch are tightened. The tightening of the nuts exerts a backward force on the molars and a forward force on the anterior teeth. Under ordinary conditions the anterior teeth would move more rapidly than the molars, but it must be remembered that the molars have a tipping force exerted on them by the spring of the arch. If the molars do not move distally as fast as they should, and there is danger of moving the anterior teeth too far, intermaxillary anchorage can be used, with the rubber running from the tube on the upper molar band to an intermaxillary-hook on the lower expansion arch opposite the canine.

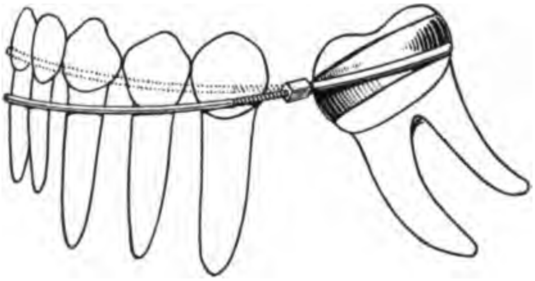

Fig. 205-A.

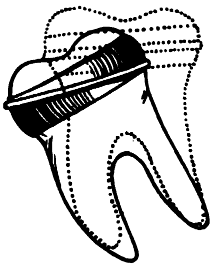

Fig. 205-B.

Fig. 205-A.—Showing gingival position of arch, which must be sprung occlusally as shown by dotted line, and wired to anterior teeth to tip molar distally.

Fig. 205-B.—Dotted tooth form illustrates result of action as outlined in

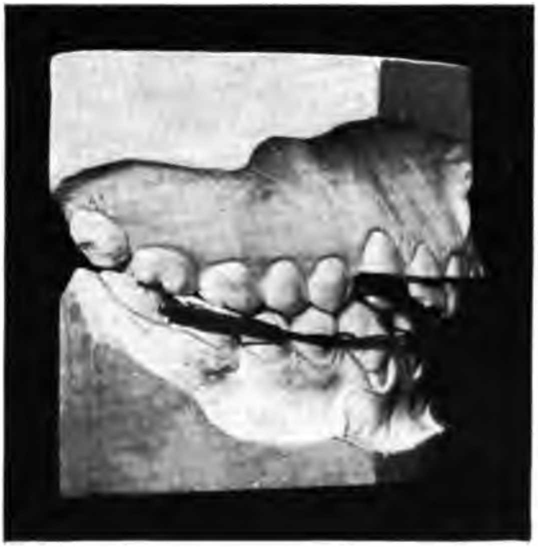

Fig. 206-A.
Appliance as first placed on molars. Side view.

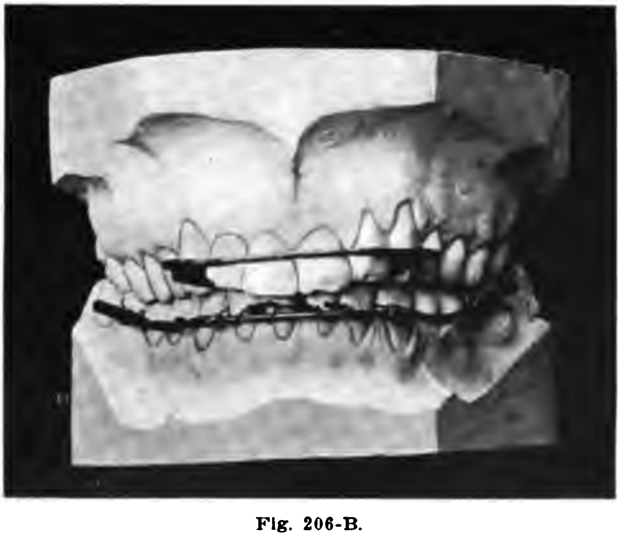

Fig. 206-B.
Shows model with lower appliance in place. Small arch was placed on canines to expand upper arch in canine region.

After the space has been provided, the retention will consist of restoring the missing tooth by some means as indicated in crown and bridge work. The position of the anterior teeth can be retained by any of the retain-

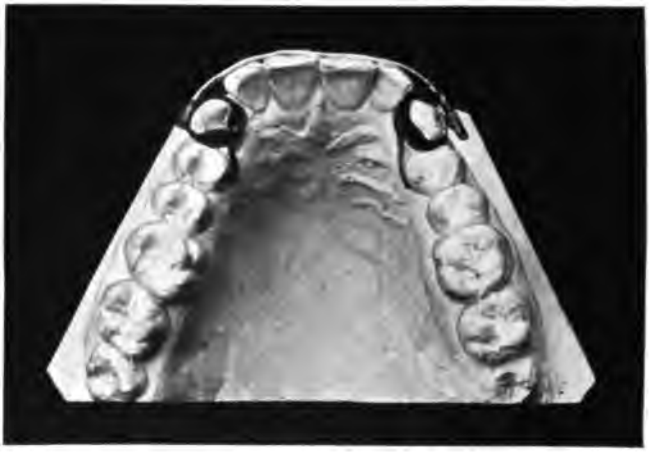

Fig. 206-C.
Occlusal view of upper appliance to expand canines and premolars.

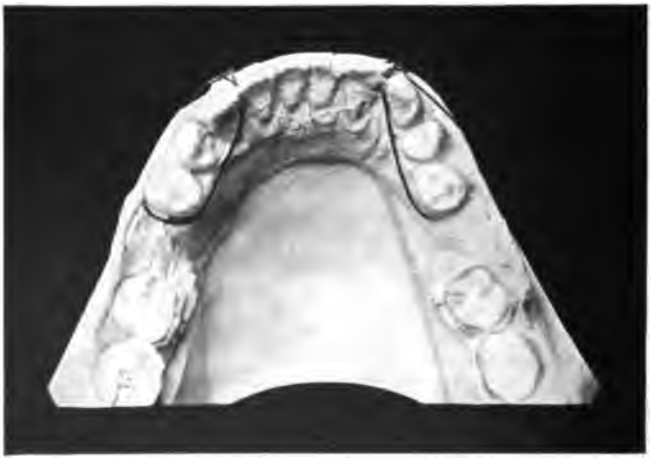

Fig. 206-D.
Model of lower teeth with appliance adjusted, showing how space has been made for extracted tooth.

ing devices mentioned heretofore which meet the requirements of the case.

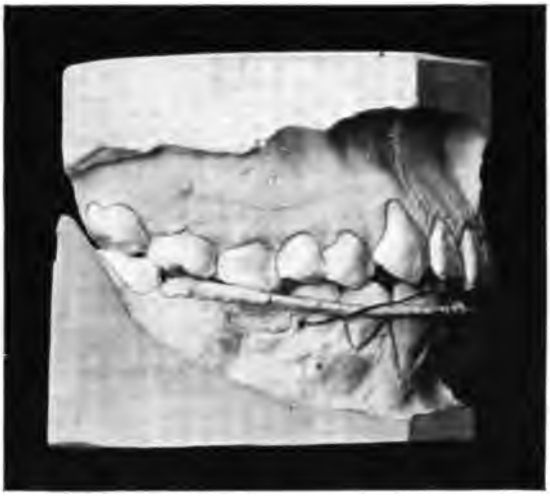

Fig. 206-E.
Made during treatment. Compare with Fig. 202.

Class II, Division 1.

Class II, Division 1 cases are those which are characterized by the distal relation of the lower arch, the width of one premolar. It is very seldom that we find the lower teeth distal to a greater extent (Fig. 207). The upper arch is narrow, upper anterior teeth protruding, underdeveloped chin, underdeveloped mandible, short upper lip, thickened lower lip (Fig. 208), abnormal muscular pressure, further complicated by abnormal breathing. In fact, long continued mouth-breathing may be said to be responsible for all of the conditions found in Class II, Division 1. Mouth-breathing is usually caused by adenoids, for a full description of which see Chapter IV.

The first requirement in the treatment of these cases, is to make certain that all nasal obstructions have been removed. It should be recalled that the nasal cavity in these patients is always undersized, which has been caused by the lack of proper development, as a result of mouth-breathing, and lack of atmospheric pressure which is brought about by disuse. The lack of development of the nasal cavity can be remedied only by widening the dental arch, which produces a transformation in the bones forming the nasal cavity. It is often found that the nasal septum is deflected in a large percentage of these cases, which is due in part to the improper development of the bones making up the nasal cavity. While it is a fact that these patients generally seek relief for the malocclusion, still they will always be greatly benefited by

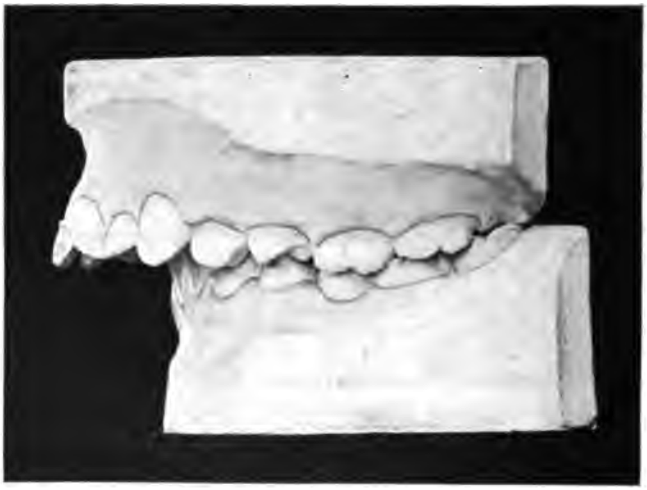

Fig. 207.
Extreme distal (posterior) relation of lower arch.

the change which will occur in the nasal cavity as a result of the proper treatment of the malocclusion.

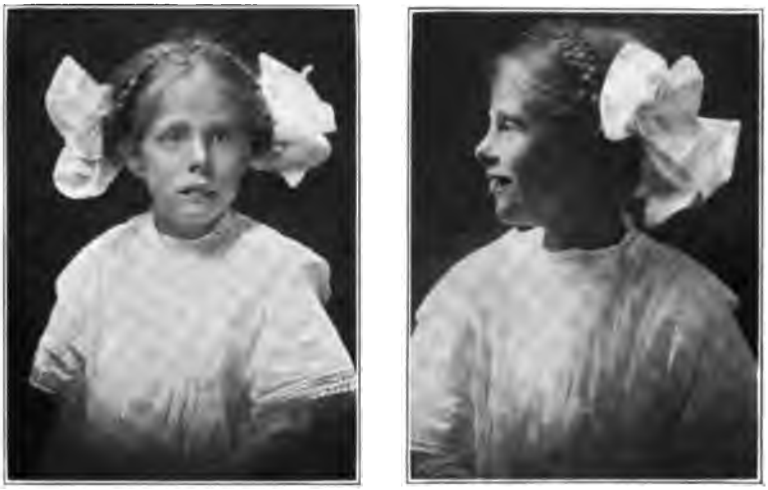

Fig. 208-A. Fig. 208-B.
Class II, Division 1 case, caused by mouth-breathing.

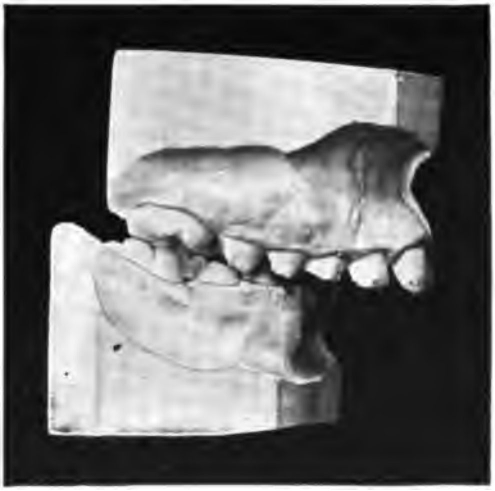

Fig. 209.
Typical case of Class II, Division 1.

Owing to the extreme facial deformity present in Class II, Division 1 cases, the literature on orthodontia is full of these cases and the different plans of treatment. In fact, the advancement of orthodontia may be traced through the advancement of the technique in the treatment of Class II, Division 1 cases. Therefore, it will be appropriate to state briefly the different plans of treatment as practiced in the past and at the present time.

One of the first plans that we have any record of is one in which the case was treated by the extraction of some teeth. An upper premolar on each side was extracted; first, to establish harmony in the size of the arches, and second, to reduce the protrusion of the upper anterior teeth. This plan of treatment made the upper arch conform to the underdeveloped lower arch, improved the occlusion slightly, and changed the facial profile. Normal occlusion and normal facial outlines were not recognized by this plan.

Owing to the unsatisfactory facial results and the lack of normal occlusion, the next method of treatment to attract attention was the one introduced by Kingsley and known as "Jumping the bite." This plan has for its object: First, the establishment of the normal relation of the arches by reducing the protrusion of the superior anterior teeth; Second, the forward movement of the mandible, which improves the facial outlines; and Third, the establishing of normal occlusion of the teeth.

It will be seen that the results which were hoped for in this plan of treatment were much more attractive than those which were obtained by the other method of procedure. The treatment, in brief, was to expand both the upper and lower arches and reduce the protrusion of the upper anterior teeth until both arches were the same size and shape. Then the mandible was moved forward by muscular action until the teeth were in their proper mesio-distal relation. The forward movement of the mandible remedied the deformity resulting from the underdeveloped chin. The facial outlines and the occlusion of the teeth were much improved immediately following the completion of the treatment. However, the trouble was that great difficulty was encountered in getting the mandible to stay forward after having been moved by muscular action. Various forms of retaining appliances were devised and the hope for permanent results was based on the belief that the temporo-mandibular articulation would change, so as to keep the mandible in its new position, and also that the body of the mandible would change. Owing to the great tendency of the ligaments to pull the mandible back to its former position, the author has grave doubts as to the number of cases treated by this plan that could be said to be entirely successful. The two plans above mentioned were not fully satisfactory and therefore orthodontists were constantly seeking something which would promise better results.

With the use of intermaxillary anchorage, as described by Baker and used on a Class II, Division 1 case, a new plan of treatment was given to orthodontia. With the use of intermaxillary anchorage, it became possible to move the upper teeth distally and the lower teeth mesially. The forward movement of the lower teeth was the great feature of intermaxillary anchorage. Up to that time there was no means of bringing about this condition, for the plan known as "Jumping the bite" only moved the teeth as the mandible was moved by muscular action. After Baker described the treatment of his case, Angle began the use of intermaxillary anchorage in Class II and III cases. The following was accomplished:

1. Establishment of the normal mesio-distal relation of the inclined planes of the teeth.
2. Widening of the upper arch and reducing the protrusion of the upper anterior teeth.
3. Movement of the upper teeth distally and the lower teeth mesially, bringing about the normal relation as described in paragraph one.
4. Improvement of the facial outlines of the individual by so doing.
5. Production of normal muscular action by making it possible for the individual to close the lips over the teeth.
6. Making normal breathing possible because the patient can close the lips.

More satisfactory results could be obtained with this plan of treatment than from any of the others mentioned. The great improvement was the result of having moved the lower teeth forward. However, normal occlusion was not always established by obtaining the proper relation of the inclined planes; for, in moving the upper teeth distally and the lower teeth mesially, a tipping of the teeth was produced which was not desired. After the treatment of these cases it often occurred that the chin and mandible would be undersized. For this reason it was believed that better results would be obtained if the plan of treatment was changed slightly, which resulted in the following plan, the object of which was to establish normal occlusion of the teeth: First, by widening the upper arch and retracting the protruding upper anterior teeth; Second, by moving the lower teeth forward the entire distance (Do not move the upper molars distally); Third, by making such anchorage and attachments as would prevent the lower teeth from tipping which would bring them forward in an upright position. As a result of this plan, the best facial outlines were obtained, the mandible was developed to its normal size, the muscular action became normal and the chin was developed.

It has been shown in the majority of these Class II, Division 1 cases that the upper molars are not too far forward. Such being the case, a plan that would approach the ideal result must be one that *will not move* these teeth distally. Therefore, our efforts should be directed toward moving the lower teeth forward and developing the mandible.

By examining a large number of these cases, by studying the facial outlines and the anatomy of the temporo-mandibular articulation, the author is convinced that the great deformity which we encounter in these cases in the mandibular region is the result of the underdevelopment of the mandible and not the result of the distal location of the condyle (Fig. 45). Therefore our treatment should be of such a nature as will produce a development of the mandible which can be brought about by the last named plan.

Class II, Division 1 cases are found at all ages—even in children who possess only deciduous teeth. It is the opinion of the author that the condition is never congenital or inherited but always the result of some acquired pathological condition, usually mouth-breathing; the mouth-breathing generally being the result of adenoids. Treatment is indicated as soon as the malocclusion is discovered, for only complications can come by waiting.

Fig. 210 shows a case of Class II, Division 1, at five years of age. This case gave a plain history of adenoids, the patient having been operated on one year previous. Plain bands were placed on the second deciduous molars, after wire had been placed between them and the first deciduous molars to produce separation. An eighteen-gauge arch was used, as very little force was required to move the teeth. The upper arch was so adjusted that it rested against the superior anterior teeth and assumed a position away from the canines. The sheath-hooks were placed on the upper arch opposite the canines; the lugs on the upper arch were not allowed to rest against the tubes on the molar bands at the beginning of the treatment; wire ligatures were placed on the superior canines so as to produce widening in the canine region. The position of the arch, ligatures and lugs is shown in Fig. 211.

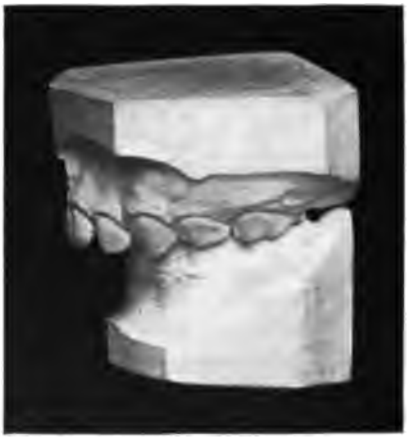

Fig. 210.
Class II, Division 1 case. Patient five years of age.

The lower arch was placed on the lower teeth with the anterior portion in close contact with the anterior teeth,

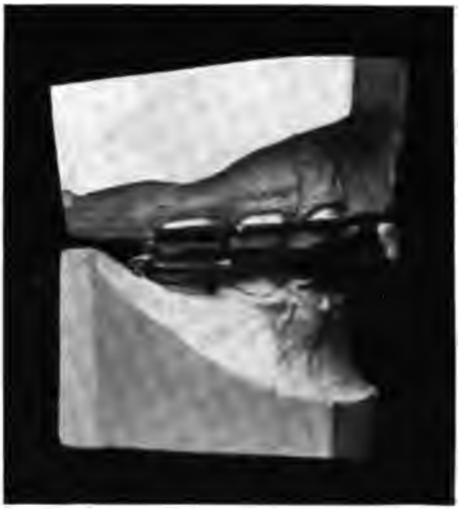

Fig. 211-A.

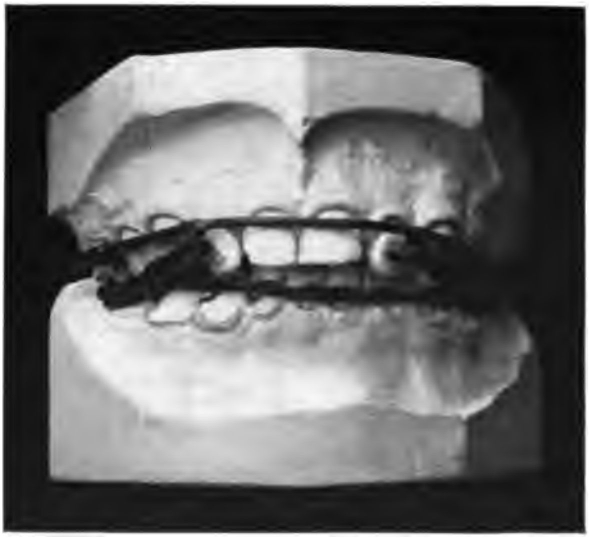

Fig. 211-B.
Front and side view of appliance used on Fig. 210.

with a slight space between the canines and the arch, as there is a demand for a slight expansion in the canine region; the lugs on the lower arch are against the tubes on the molar bands, for it is the intention to bring all of the lower teeth forward. Owing to the ease with which the lower teeth move, the force of the intermaxillary ligature, which will depress the upper anterior

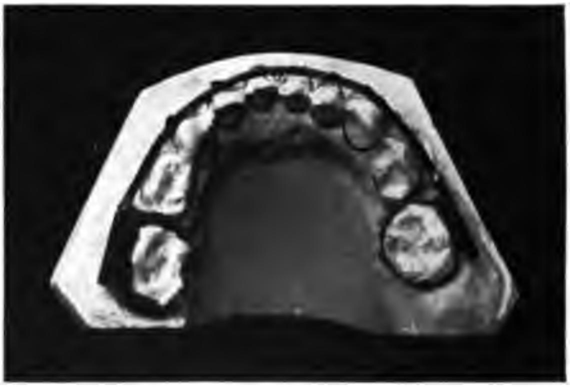

Fig. 211-C.

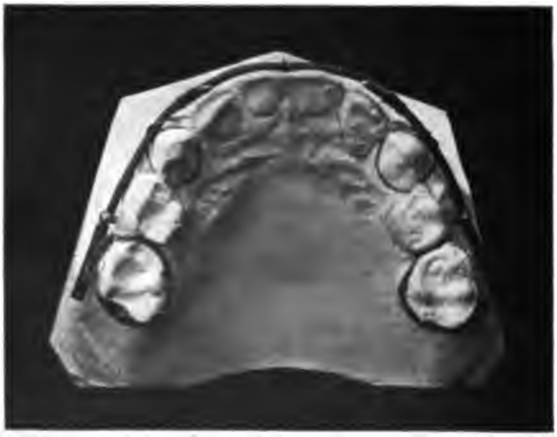

Fig. 211-D.
Occlusal view of appliance used on case shown in Fig. 210.

teeth, will also start the lower teeth to moving forward. As the canines of the upper teeth are expanded, the pull of the intermaxillary rubbers will depress the anterior teeth without destroying the approximal contact of the teeth. After the upper anterior teeth have been moved distally to their proper position, which is determined by the shape of the dental arch, the lugs on the expansion arch are allowed to rest against the molars and the expansion arch so changed in shape that it rests passive in contact with all of the teeth. All of the teeth are then ligated to the expansion arch so as to obtain as much resistance as possible, which is used as anchorage in moving the lower teeth forward. The continued use of the rubber ligatures will move the lower teeth forward until they occupy the position shown in Fig. 212. The teeth were retained by the use of passive intermaxillary retention, consisting of a band placed on the upper sec-

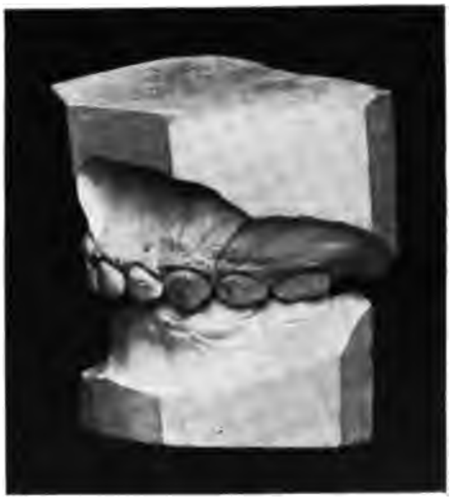

Fig 212.
Finished result of Fig. 210.

ond deciduous molar with an inclined plane on the distal side of it, which engaged the distal portion of the lower second deciduous molar. This device was worn until the first molars began to erupt and then taken off.

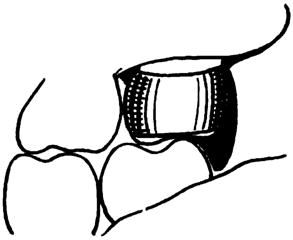

Fig. 213-A.
Plain band on upper molar with cast lug to hold lower molar forward. (Suggested by Brady.)

Bands were placed on the lower canines with a bar soldered to the lingual side to maintain the expansion (Fig. 213) in that region, but nothing was placed on the upper anterior teeth; for if the lower teeth are held and the lip pressure is subnormal, retaining appliances will only hold the teeth mechanically, and when removed the teeth will return to their former position regardless of how long the appliance was worn. Therefore, greater

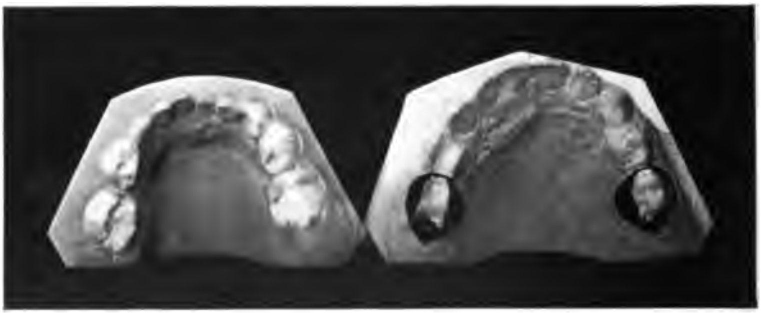

Fig. 213-B.
Occlusal view of finished case.

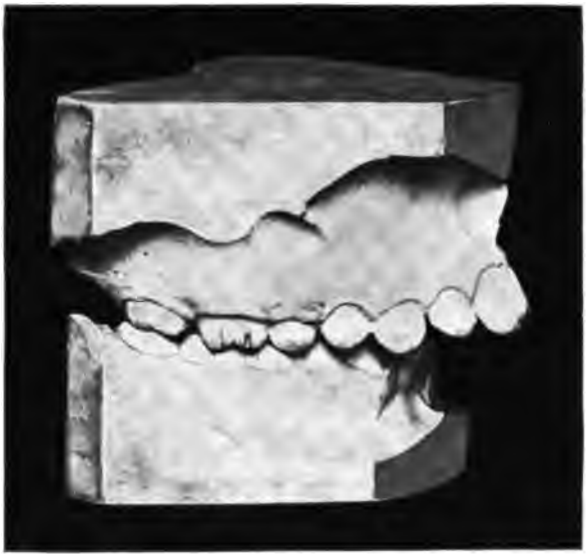

Fig. 214.
Class II, Division 1. Patient seventeen years of age.

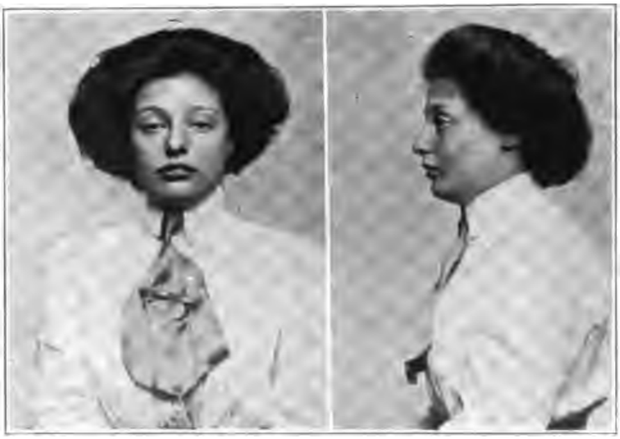

Fig. 215-A. Fig. 215-B.
Effect of mouth-breathing and distal relation of lower arch. Short upper lip, underdeveloped mandible.

attention should be paid to the natural forces of retention than has formerly been done.

Fig. 214 shows a typical case of Class II, Division 1, at the age of seventeen years. The facial outline of the patient is shown in Fig. 215. The short upper lip, receding chin and underdeveloped mandible are characteristic of these cases. In order to improve the facial outline of the patient, it will be necessary to move the lower teeth forward, widen the upper arch, and reduce the protrusion of the upper anterior teeth. The best results will be obtained by moving the lower teeth forward bodily, which will cause a development of the mandible.

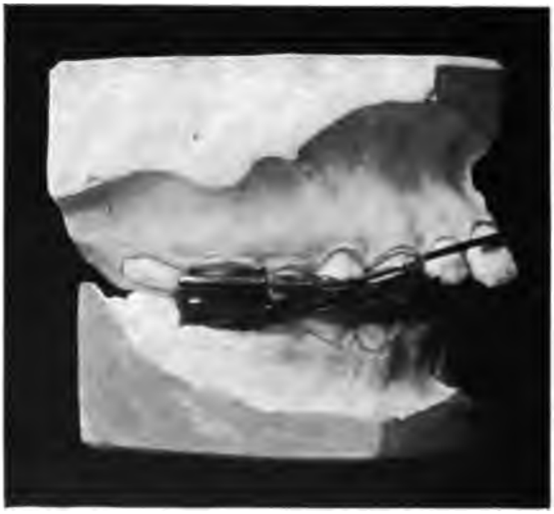

Fig. 216-A.
Side view, showing intermaxillary anchorage.

Wire is placed around the approximal contact points of the first molars to produce a slight separation. After the wire has remained in place twenty-four hours or more, clamp-bands are placed on the first molars, care being taken to have the screws lay close to the lingual surfaces of the premolars. If the tubes on the bands do not occupy the proper position, they are removed and soldered so that the arch will occupy the proper relation to the teeth. The position of the upper expansion arch is shown in Fig. 216. It will be seen that the anterior portion of the arch rests against the upper anterior teeth; that the arch stands away from the canines, for they must be expanded; and that the nuts are screwed forward in order not to touch the tubes on the molar bands. These details must be observed carefully in order to secure the greatest benefit from the regulating appliance. At the beginning of the case, wire ligatures are placed on the upper canines and first premolars (Fig. 217), which makes reciprocal anchorage between the two sides. Intermaxillary anchorage is used on this

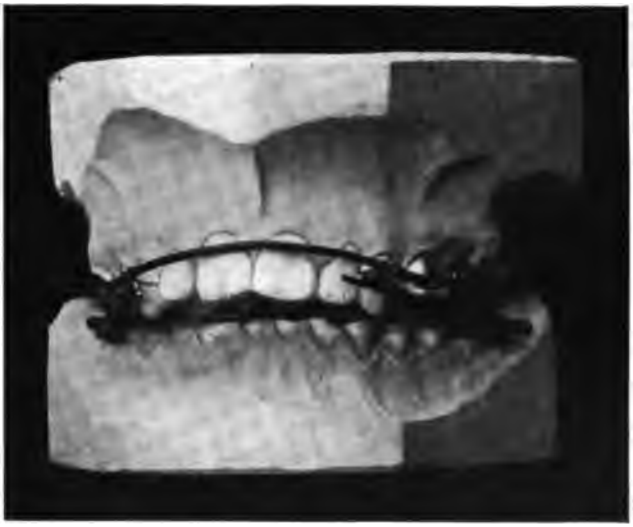

Fig. 216-B.
Front view, showing intermaxillary anchorage.

case, the lower arch having been adjusted as follows: The lower expansion arch is placed on the lower teeth so that it will occupy the position shown in Fig. 216.

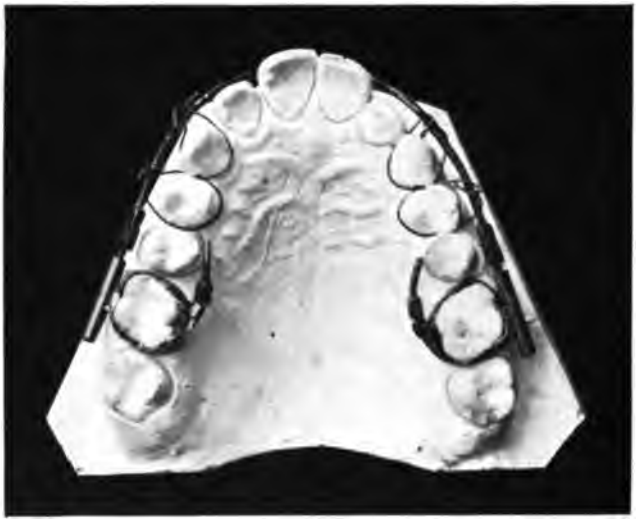

Fig. 217.

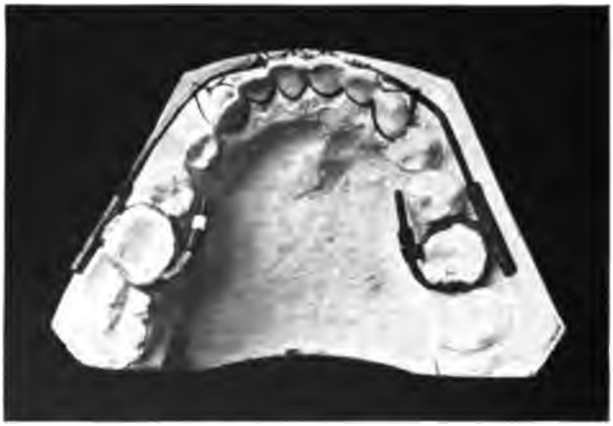

Fig. 218.

Occlusal view of appliances. Upper arch rests against anterior teeth, nuts away from tubes. Lower anterior teeth ligated to arch and nuts against tubes.

Slight expansion is indicated in the canine region, but the anterior portion of the arch should rest against the lower anterior teeth, for they are to be carried forward only as the molars and premolars are carried forward by intermaxillary anchorage (Fig. 218). The lower incisors may be prevented from tipping by soldering spurs on the arch, as shown in Fig. 123, and then ligating the teeth to the arch. The spur causes the tooth to maintain a perpendicular position. Should it be necessary to move the apex of the tooth faster than the crown, this can be accomplished by placing a rubber between the tip of the spur and the tooth.

After the upper teeth have been expanded and the anterior teeth brought to the proper position with each other, the nuts on the upper arch are allowed to touch the tubes on the upper molar bands so that the resistance of all of the upper teeth will be pitted against all of the lower teeth.

It is an anatomical fact that more force is necessary to move the upper teeth distally than is required to move the lower teeth forward, and this knowledge aids us materially in the treatment of this class of cases. The continued use of intermaxillary anchorage will bring the lower teeth forward to their proper position, but they must not be moved rapidly.

In the majority of Class II, Division 1 cases, a condition exists which may be described as infra-occlusion of the lower molars. Some have called it supra-occlusion of the incisors, but after an examination of many patients and skulls, the author is convinced that the difficulty lies in the molar region; therefore, the best results will be obtained by some plan of treatment which will produce an elongation of the lower molars, and that is what results when the lower anterior teeth are ligated stationary to the arch. The position of the lower molar roots is such that the continuous pull of the rubbers tends to elongate these teeth as they are being brought

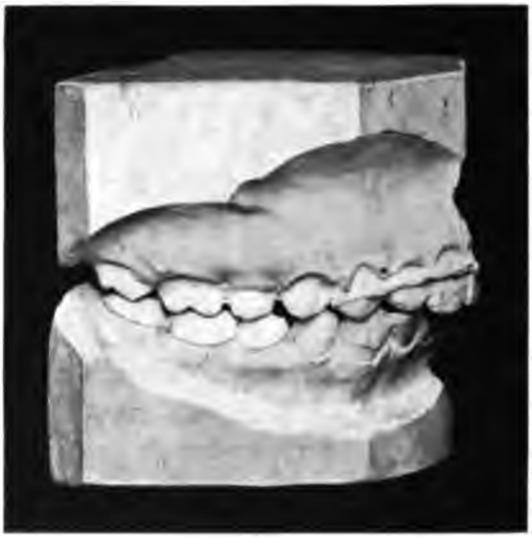

Fig. 219.
Condition of teeth at the time active intermaxillary anchorage was employed.

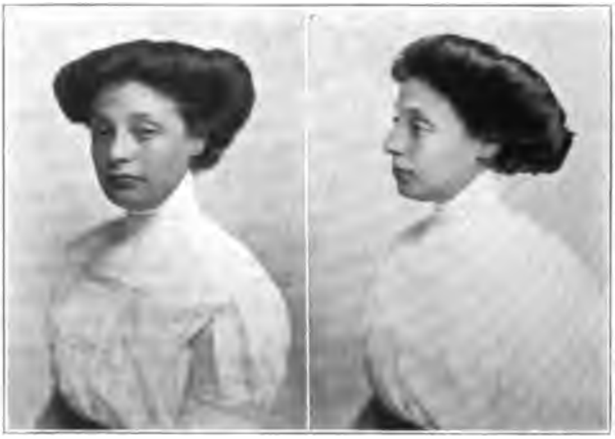

Fig. 220-A. Fig. 220-B.
Changed facial results.

forward. If attempts are made to move them too fast, there will be too much elongation of the lower molars; therefore, it becomes important that we watch these cases carefully so as to keep the forces employed evenly balanced.

Fig. 219 shows the case after the teeth had been moved to their proper position. The change in the mandible can be seen by comparing Fig. 215 with Fig. 220, the latter having been made after treatment. The movement of the lower teeth forward has caused a lengthening of the mandible.

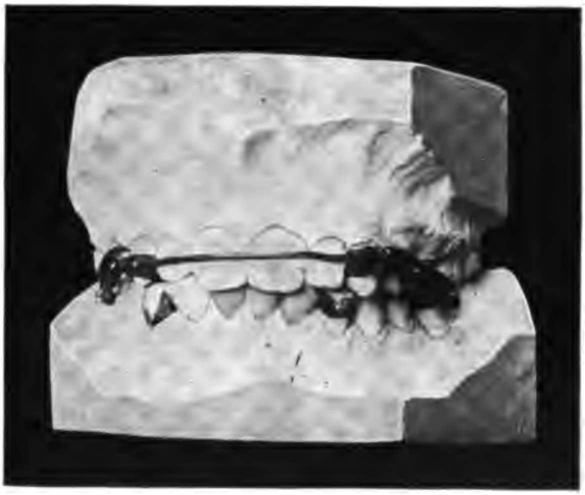

Fig. 221.
Retention of case shown in Fig. 214.

The retention of the case consisted in placing bands on the upper canine and soldering a wire on the labial surface of the bands so as to rest against the labial portion of the teeth (Fig. 221). The wire is placed on the labial side in order to secure greater efficiency. A small spur is soldered on the disto-labial portion of the canine band (Fig. 222) to engage the intermaxillary rubber which will be used in retention. Plain bands are made for the molars and a wire is soldered on the lingual side of the upper canine band extending distally

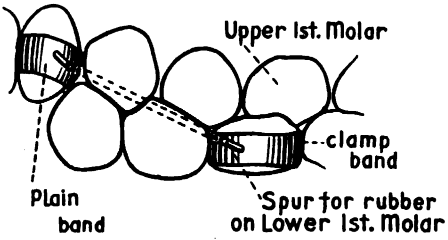

Fig. 222-A.
Active intermaxillary retention used in case shown in Fig. 214.

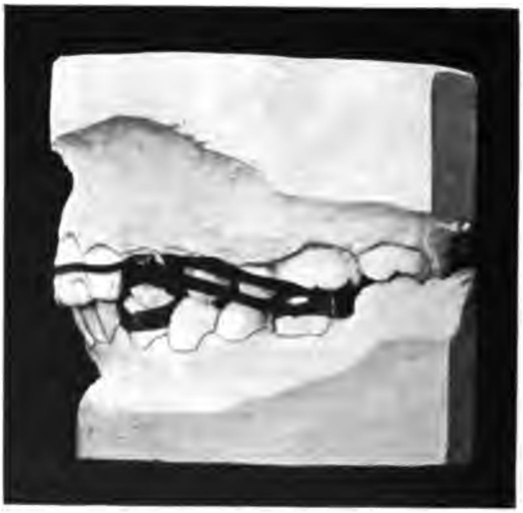

Fig. 222-B.
Side view of retention used in case shown in Fig. 214.

and attached to the lingual side of the upper molar band, to retain the expansion of the premolars and molars. In order that this retaining appliance may be of any value the central portion or the wire extending from one canine to the other must be made of some material rigid enough to hold the canines labially, for if they "collapse" all of the upper teeth will move to positions of malocclusion. The retainer is shown in Fig. 223.

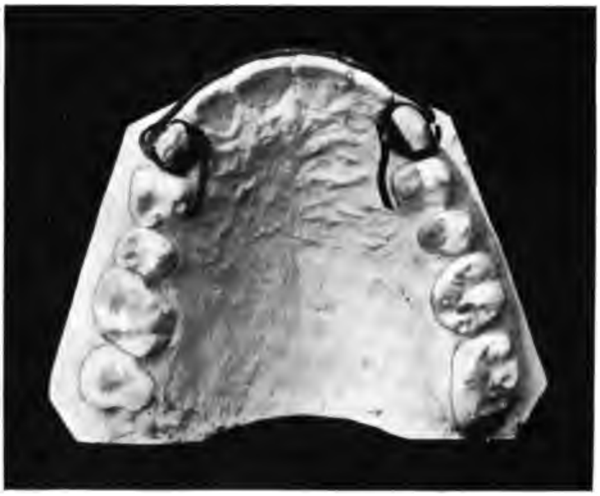

Fig. 223-A.

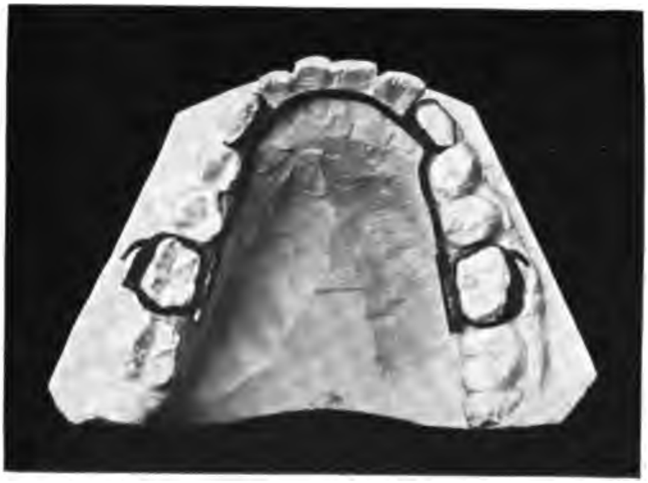

Fig. 223-B.
Occlusion plan of retainer used on case shown in Fig. 214.

The lower teeth are retained by making plain bands for the first molars and canines. A wire is shaped to fit the lingual side of the teeth and is soldered to the lingual side of the bands retaining the teeth, as shown in Fig. 223.

A spur is soldered on the mesio-bucco-occlusal angle of the molar bands to engage the intermaxillary ligature which is used for retention (Fig. 222). The mesio-distal relation of the teeth is retained by wearing the intermaxillary rubbers. These rubbers must be strong enough to resist the backward tendency of the teeth. This form is called active intermaxillary retention. It holds the lower teeth forward and the constant pull of the rubber ligatures holds the lower molars in their proper position and relation, they having been moved from infraocclusion.

Class II, Division 1, Subdivision.

The subdivision of Class II, Division 1, includes such cases as are distal on one side and normal mesio-distally on the other (Fig. 224). They present the same other symptoms as are found in the division. Subdivision cases are treated in very much the same manner as are those of the division. It is necessary to widen the upper dental arch and reduce the protrusion of the upper anterior teeth. This is done by adjusting the upper expansion arch in the same manner as in the division just described. The lower expansion arch is also adjusted as was done in the division. Intermaxillary rubbers are placed on the appliance to reduce the protrusion of the upper teeth and the upper canines are widened as they were in the case above mentioned. After the upper anterior teeth have been moved backward to the proper place, a light rubber is worn on the normal mesio-distal side, while on the abnormal side a strong rubber is employed to bring the lowers forward on that side.

It will be noted by studying the profile of the patient (Fig. 225), that the facial deformity is nearly the same as it is in the division. In fact, in the subdivision we find just as great a facial deformity and the mandible just as deficient (Fig. 226) on the average as we do in the division, which proves that the lack of development of the mandible is entirely due to the abnormal muscular pressure.

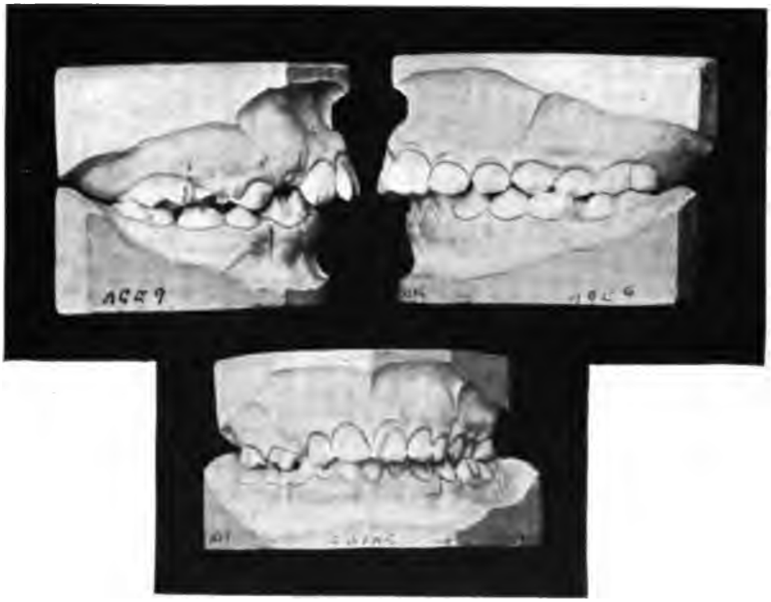

Fig. 224.
Class II, Division 1, Subdivision case.

After the teeth have been moved into the proper position, they are retained in the same manner as described in the division. It will be necessary to wear a retaining rubber ligature on the normal side for a while, to hold back the retracted superior anterior teeth, until the pressure of the lip becomes normal.

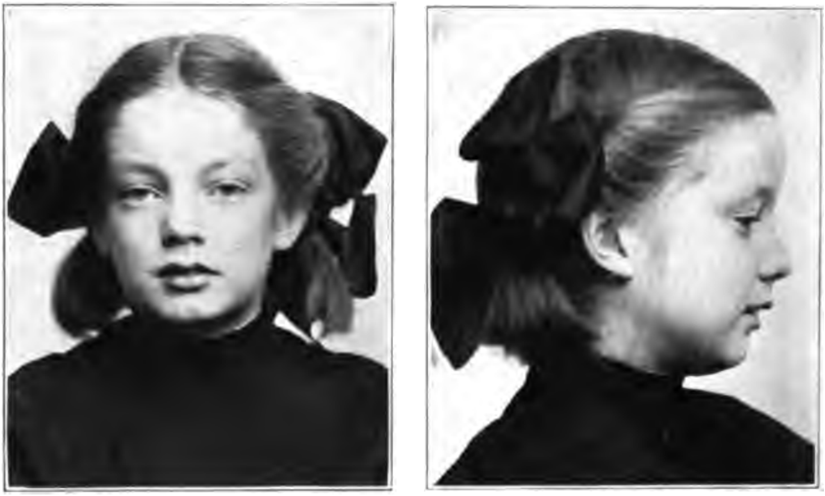

Fig. 225-A. Fig. 225-B.

Facial outlines of Class II, Division 1, Subdivision.

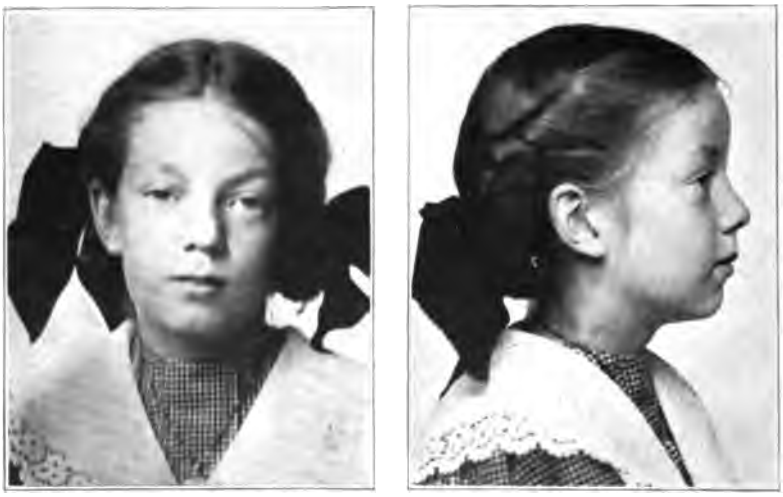

Fig. 226-A. Fig. 226-B.

Showing facial outlines after development of mandible.

Class II, Division 2.

In the treatment of Class II, Division 2, we have a class of cases which are found in older patients than in Division 1. At least, the author has never seen a Class II, Division 2 case in as young a patient as is found in Class II, Division 1. The majority of cases and patients seen by the author during his practice, gave a history of having been mouth-breathers at one time, but probably there are other factors which cause this condition of malocclusion. By far the greater number have been operated for adenoids or have been troubled with nasal obstruction at some time. The author is of the opinion that these patients were mouth-breathers and that the abnormal muscular and atmospheric pressure has permitted the lower molars and teeth to assume a position distal to normal. The teeth have protruded, the tongue has been in the lower part of the mouth, and the lips have acted abnormally; then, as a result of an operation or change in environment, normal breathing has become possible and the patient, conscious of the deformity, has closed the lips, with the result that the upper and lower lips have forced the upper anterior teeth back against the lower anterior teeth. With the tongue held in the upper part of the mouth, the upper arch has developed to nearly the proper width, which was also stimulated by nasal breathing. As a result, Class II, Division 2, differs from Class II, Division 1, in every respect except in the distal relation of the lower dental arch. The upper teeth are bunched and retruding, the upper arch nearly the normal width, the mandible nearly normal in development, and the chin normal or well developed. These conditions have all been the result of normal muscular and atmospheric pressure.

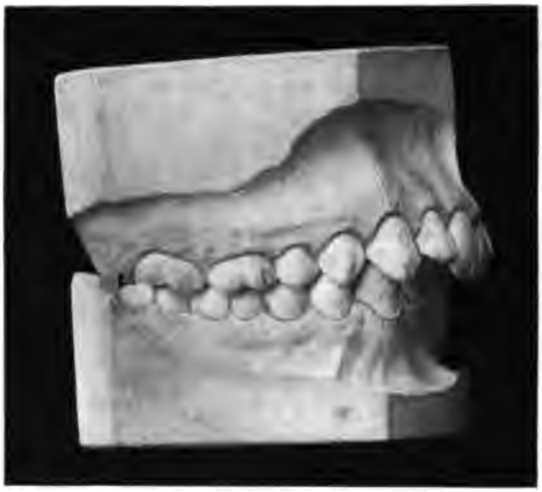

Fig. 227-A.

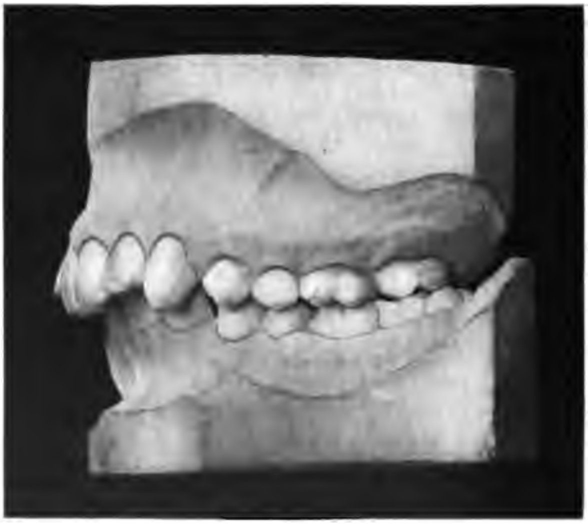

Fig. 227-B.
Class II, Division 2 case. Side views.

Remembering, then, the conditions which are present, the most successful plan of treatment would be one that would expand the upper arch in the canine and incisor region, expand the lower dental arch, and bring the lower teeth forward to their proper position. It will not be necessary to attempt to secure a development of the mandible (unless it is demanded), for in the majority of cases the chin and mandible are well developed. Therefore, there is less to do, and, if properly handled, Division 2 is easier to treat than Division 1. However, the author has observed that more difficulty arises in the treatment of Division 2 cases than in those of Division 1. The reader should be cautioned against thinking these cases can be treated in a "slip-shod" manner.

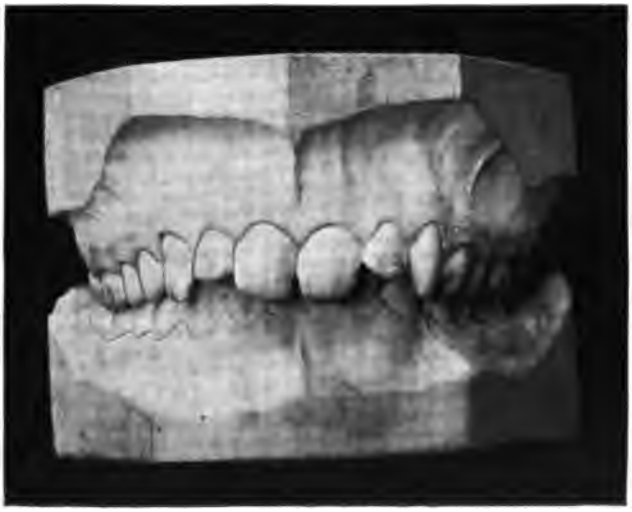

Fig. 227.

Class II, Division 2. Front view.

Owing to the fact that the upper anterior teeth must be moved labially (Fig. 227), it will be necessary to adjust the expansion arch in the same manner as if a case of Class I were to be treated. In other words, the expansion arch is away from the superior anterior teeth as shown in Fig. 228. Wire ligatures are placed on the

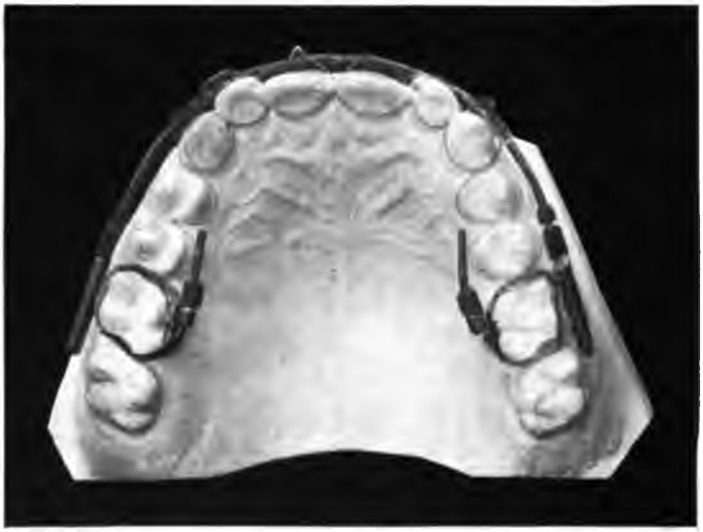

Fig. 228-A.

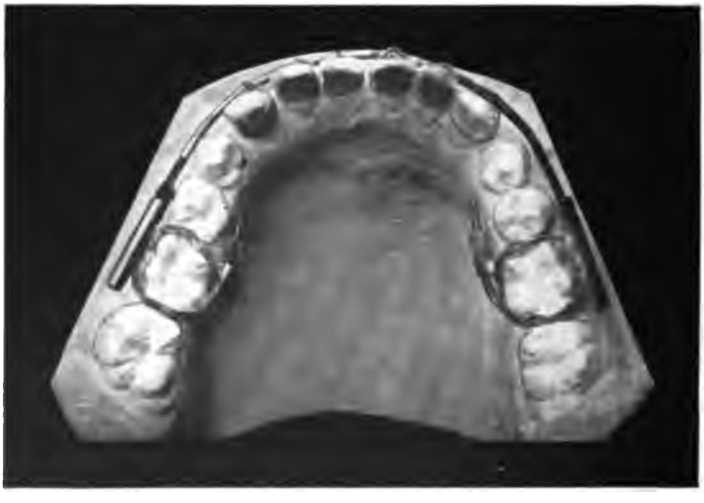

Fig. 228-B.

Position of upper and lower appliances at the beginning of treatment.

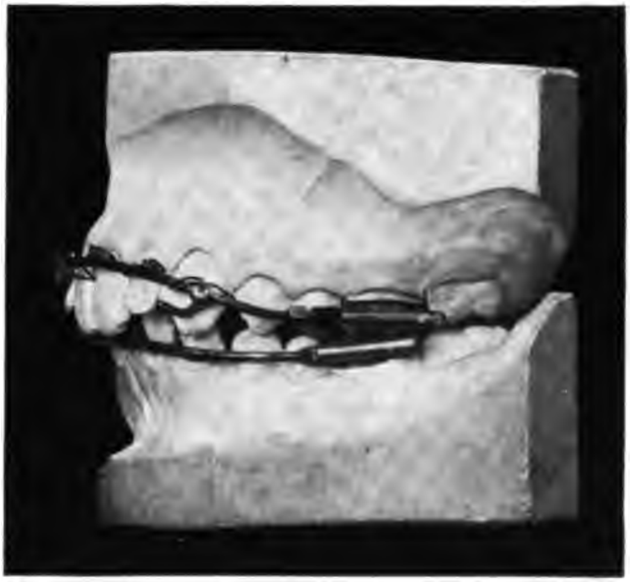

Fig. 228-C.

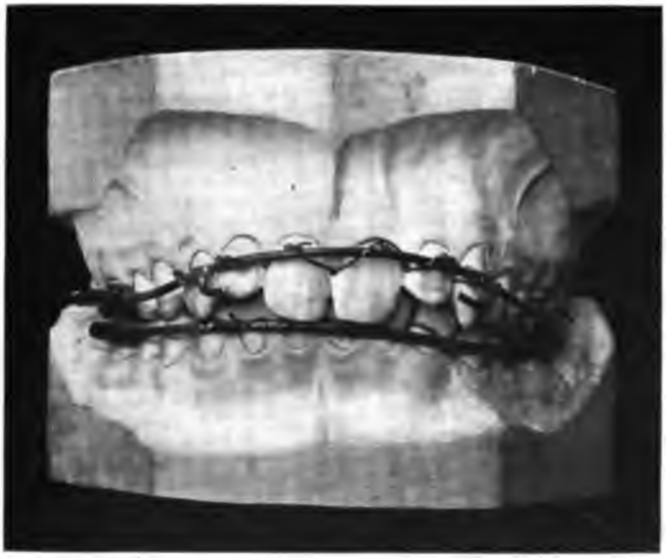

Fig. 228-D.

Views of the appliances as upper and lower dental arches are being expanded before intermaxillary anchorage is used.

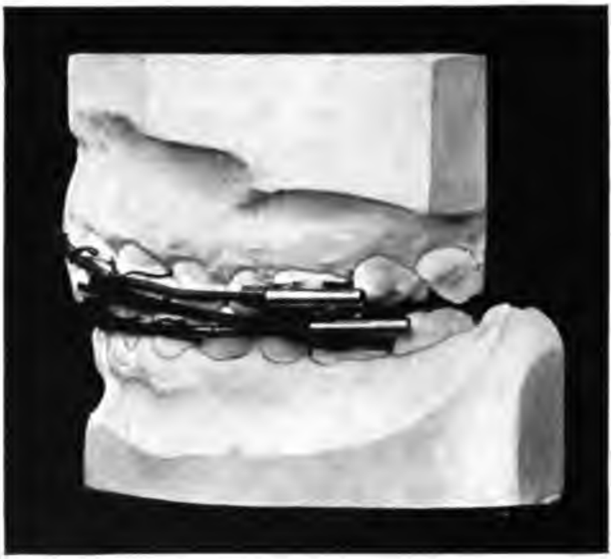

Fig. 228-E.

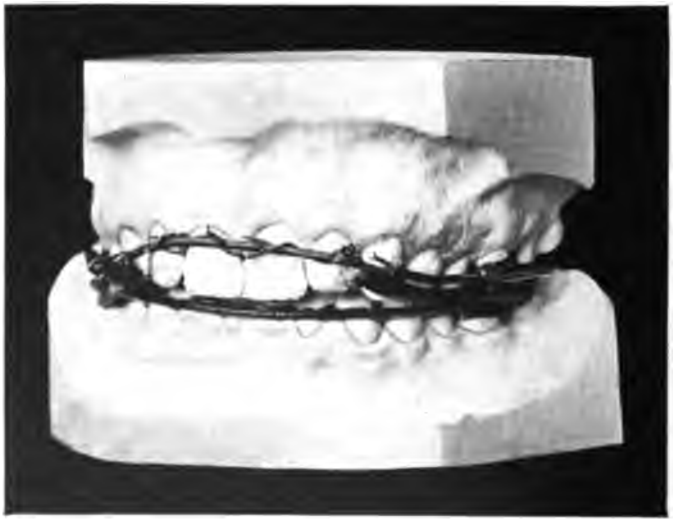

Fig. 228-F.
Showing use of intermaxillary anchorage after dental arches have been expanded to move lower teeth mesial (forward).

anterior teeth and they are moved into the proper relation with each other. The lower expansion arch is placed on the teeth and the dental arch is expanded and the teeth moved into their proper position. After the teeth in the upper arch have been moved into the position they should occupy, after the upper arch has been expanded and the anterior teeth moved labially, then, and not until then, should intermaxillary anchorage be used. If intermaxillary anchorage were used at the time the upper anterior teeth are being moved, too much stress would be exerted on the upper molars and they would be pushed distally. After the anterior teeth have been moved, the expansion arch should be adjusted in such a manner as to rest against all of the teeth and then all of the upper teeth should be wired to the arch. This gives the resistance of the entire upper arch as anchorage to move the lower teeth forward. It may be necessary in some cases to place spurs on the lower expansion arch to prevent the tipping of the lower incisors. The lower teeth having been moved forward into their proper position, are retained by both reciprocal and intermaxillary retention.

The upper teeth are retained by placing bands on the first molars and canines. A lingual wire is soldered on the molar and canine bands, as shown in Fig. 229. A spur is soldered on the disto-labial angle of the canine band to hold the rubber which will be used as intermaxillary retention. It will be observed in the upper retainer that the wire is on the lingual side of the teeth in Division 2, while in Division 1 the appliance is placed on the labial side.

The lower teeth are retained by plain bands for the molars and canines and a wire is placed on the lingual side, as shown in Fig. 229. A spur is soldered on the

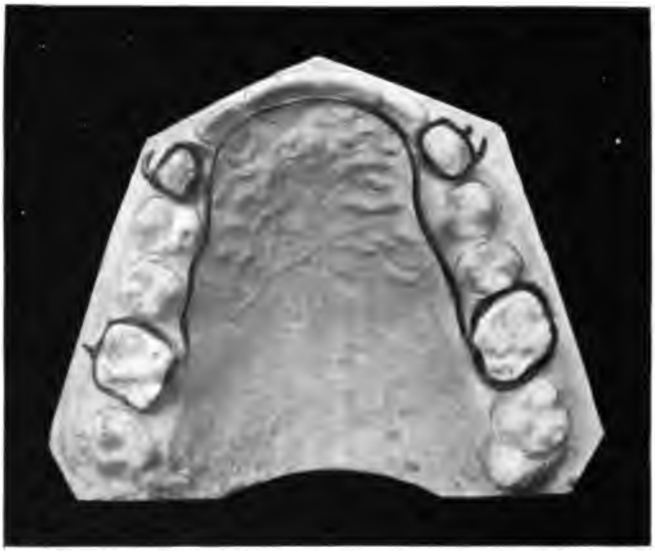

Fig. 229-A.

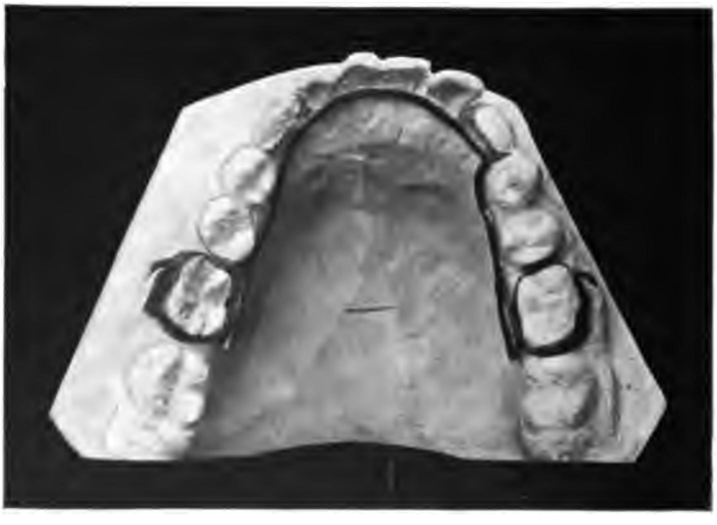

Fig. 229-B.
Showing plan of retention for Class II, Division 2.

mesio-bucco-occlusal angle of the lower molar band to engage the lower end of the rubber which is attached to the spur on the upper canine band. The pressure of the rubbers is diminished gradually by having the patient wear lighter rubbers during the period of retention. Figs. 230-A, 230-B, and 230-C show the result of the treatment.

Since the treatment is the same in all cases, the author feels that it is unnecessary to take up these cases further here.

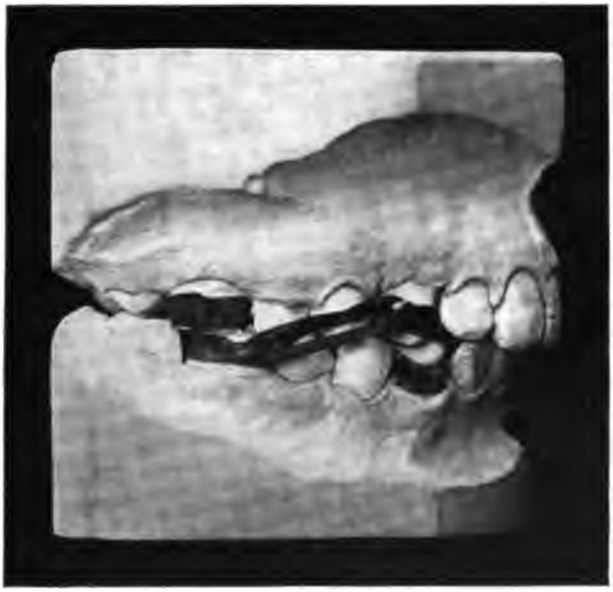

Fig. 229-C.
Showing active intermaxillary retention in Class II, Division 2.

Class II, Division 2, Subdivision.

The treatment of the subdivision of Class II, Division 2, is the same as the treatment of the division; that is, the case is started in the same way but the intermaxillary ligature is only worn on the side which has an abnormal mesio-distal relation of the arches. There is no necessity of wearing the rubber on the normal side.

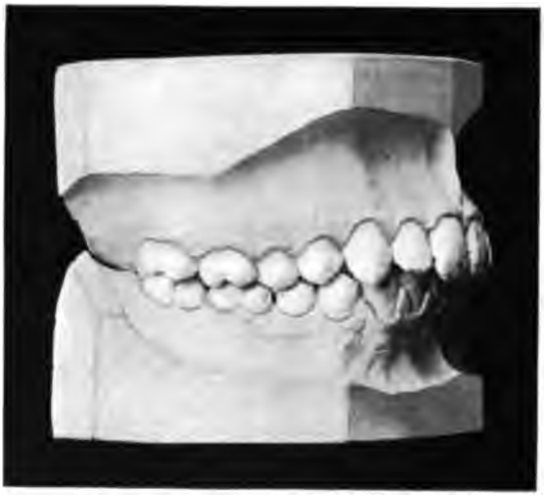

Fig. 230-A.

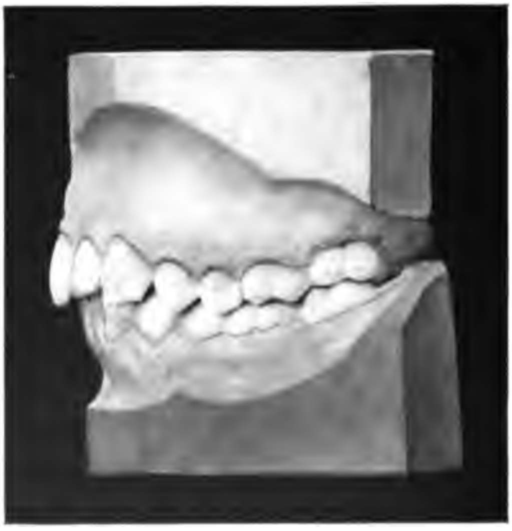

Fig. 230-B.
Result of treatment of case shown in Fig. 227.

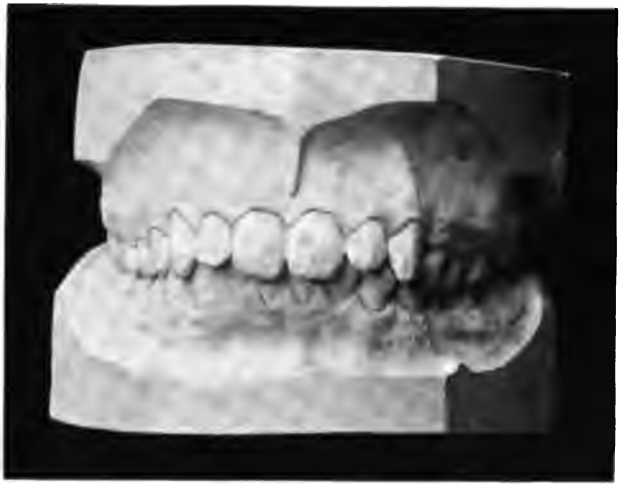

Fig. 230-C.
Front view of case shown in Fig. 227 after treatment.

Class III.

Class III includes those cases which have a mesial relation of the lower dental arch. As was shown under classification of malocclusion, different types of Class III exist, which makes possible different methods of treatment. While we should try to get normal occlusion and normal facial outlines in all cases, the different types will render necessary a different technique of treatment. Class III cases are more rare than any other class, or at least have been in the author's practice. Therefore, it is impossible at the present time for the author to show finished results of all of the types, but the plan of treatment will be outlined.

Fig. 231 shows a Class III case in which the upper teeth are in quite even alignment; the lower teeth are "bunched," and it will be noted that the lower first premolars have been extracted. When the teeth are in oc-

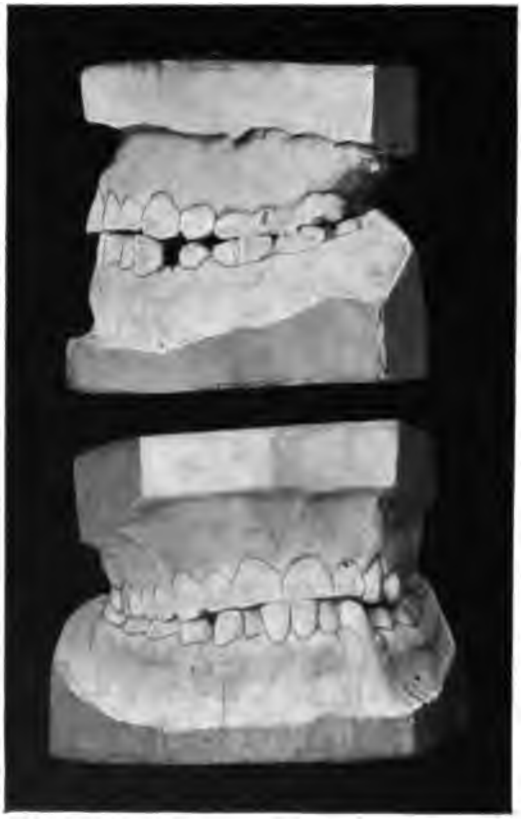

Fig. 231-A.

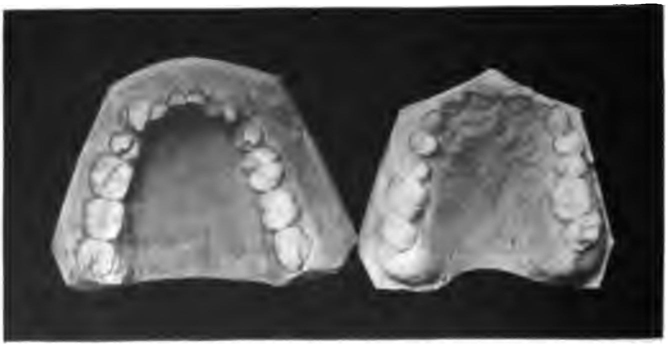

Fig. 231-B.
Class III case. A type often treated by extraction in former days.

clusion it will be seen that there is an end-to-end bite of the anterior teeth.

This case recalls one of the common plans of treatment of this type of Class III cases which was followed a few years ago; namely, the extraction of the lower first premolars and the distal movement of the canines and incisors until they were lingual to the upper teeth. The distal movement of the canines and anterior teeth was accomplished by the use of the traction screw and stationary anchorage. The appliance was arranged as shown in Fig. 232. This plan of treatment has not been a success and has since been discarded. Its application was only possible in that class of cases shown in Fig. 231. At the present time the treatment for such a case would be as described for the following case (Fig. 233).

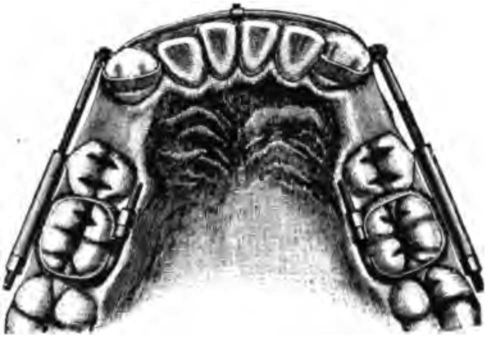

Fig. 232.

Showing form of appliances used on cases similar to case shown in Fig. 231. (After Angle.)

Fig. 233, a Class III case, is from a younger patient than the one shown in Fig. 231, and is one which was treated with an intermaxillary anchorage. It will be seen that the lower teeth are mesial to the upper teeth the width of one premolar. The upper anterior teeth are lingual to the lower teeth.

The case demands the expansion of the upper arch and the distal movement of the lower teeth.

After having placed wire on the mesial and distal side of the first molar to procure the necessary separation, clamp bands are fitted to the teeth with the screw and the tube occupying the proper relation. The upper expansion arch is placed on the upper teeth as shown in Fig. 234. Spurs may be soldered to the anterior portion of the arch (Fig. 235) so as to hold the upper anterior teeth stationary or perpendicular, thus giving more resistance to the upper teeth which is needed to move the lower teeth distally. With all of the upper teeth ligated to the expansion arch, we have firm anchorage. However, the resistance of the upper teeth to forward move-

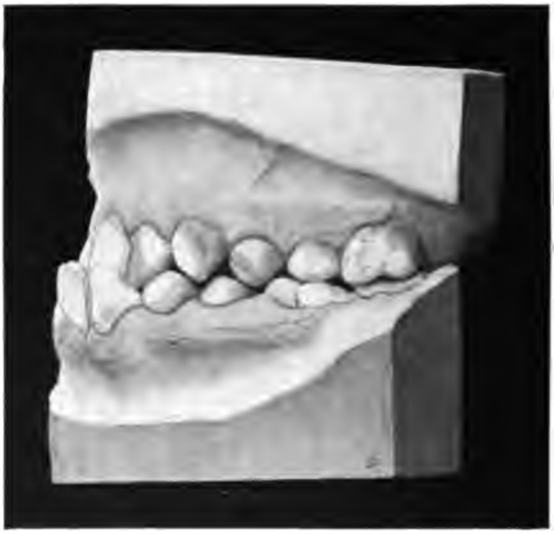

Fig. 233.
Class III case. Patient twelve years of age.

ment can be increased by bending and springing the upper expansion arch. In adjusting the expansion arch on the upper teeth, the tubes are so aligned that the anterior portion of the arch occupies a position high on the gingival portion of the teeth, as shown in Fig. 236. Then, by springing the arch occlusally and wiring it to the teeth, a backward force is brought to bear on the

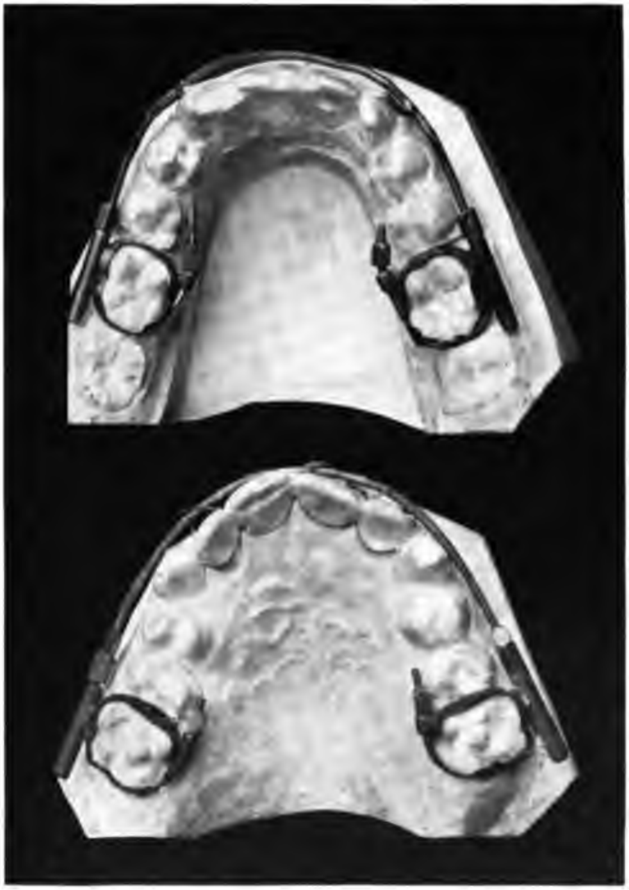

Fig. 234-A.
Class III case. Upper and lower appliances in place.

upper molars (Fig. 236-A). If the arch should be left this way without any counteracting force, the upper molars would be tipped distally. However, in Class III cases the upper molars are prevented from moving distally by the pull of the intermaxillary rubbers, which exert a forward pull on the upper teeth. As a result of the spring of the arch which exerts a backward tipping on the molars, and the forward pull of the intermaxillary rubbers, the

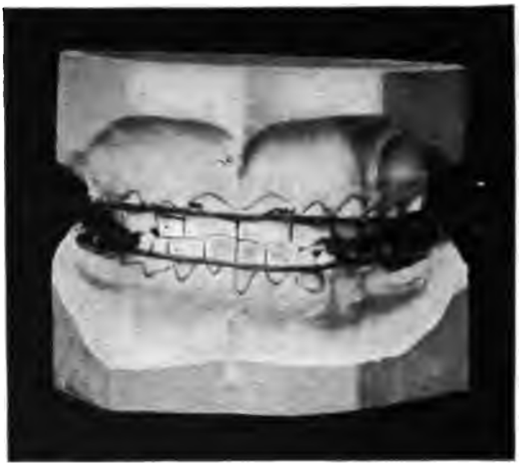

Fig. 234-C.
Position of lower arch, showing intermaxillary anchorage.

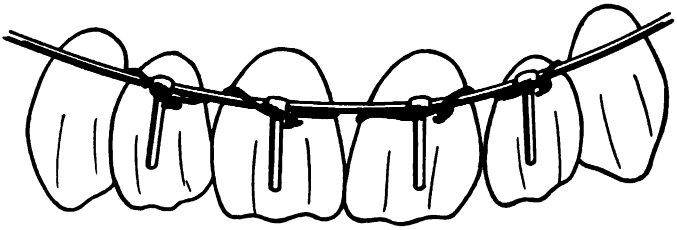

Fig. 235.
Spurs to produce bodily movement of anterior teeth and make stationary anchorage of teeth in upper arch to move lower teeth distally in Class III.

upper teeth remain stationary and become the anchorage which moves the lower teeth.

In adjusting the expansion arch to move the lower teeth distally, the anterior position of the arch does not rest against the lower anterior teeth. This is because we desire to exert all of the force upon the lower molars and move them distally first. The position of the lower arch is shown in Fig. 234-A. No ligatures are placed on

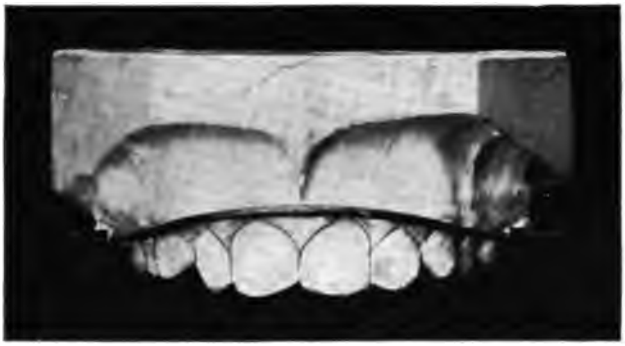

Fig. 236-A.
Position of arch high on gingival portion of teeth to make stationary anchorage on molars when arch is sprung down as shown in Fig. 236-B.

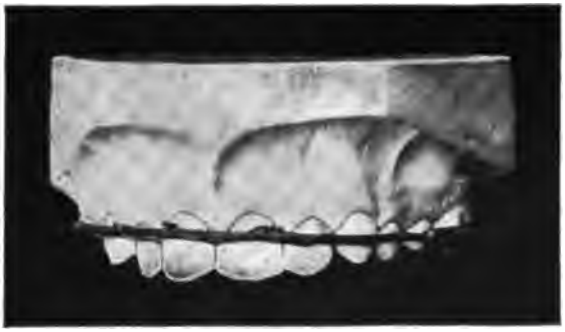

Fig. 236-B.
Upper arch bent occlusally and wired to make molars stationary.

the lower anterior teeth, for all of the force is to be exerted on the lower molars. With all of the force exerted against the lower molars, they will be moved distally, and in the majority of cases the premolars will follow them. In the treatment of the case, as the molars move distally and a space is left between the molars and premolars, a wire ligature, as shown in Fig. 237, is placed around the first premolar and attached distal to the tube on the molar band. This ligature can be tightened and a stress exerted upon the premolars, which brings them toward the molar; or spurs may be placed on the arch slightly distal to the premolars, and each tooth ligated to the arch; then by screwing the nut on the lower expansion arch forward to such position that it does not rest against the tube, the pull of the intermaxillary rubber moves the lower premolars distally. This application of the arch is shown in Fig. 238. As the mo-

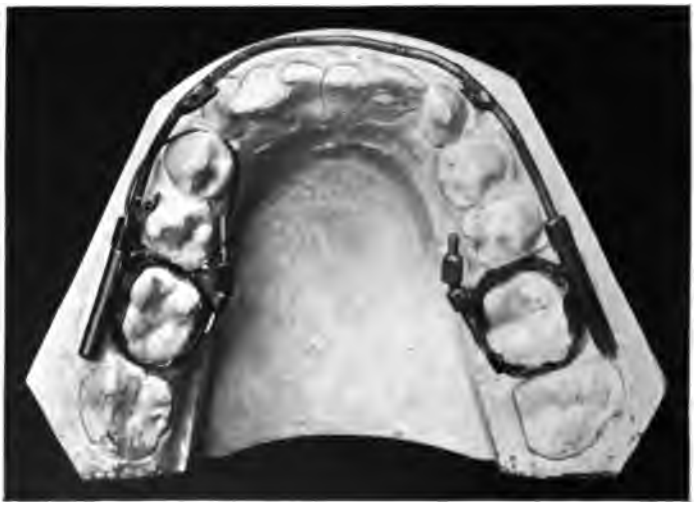

Fig. 237.
Application of ligature around premolars and distal end of molar tube to move premolars distally.

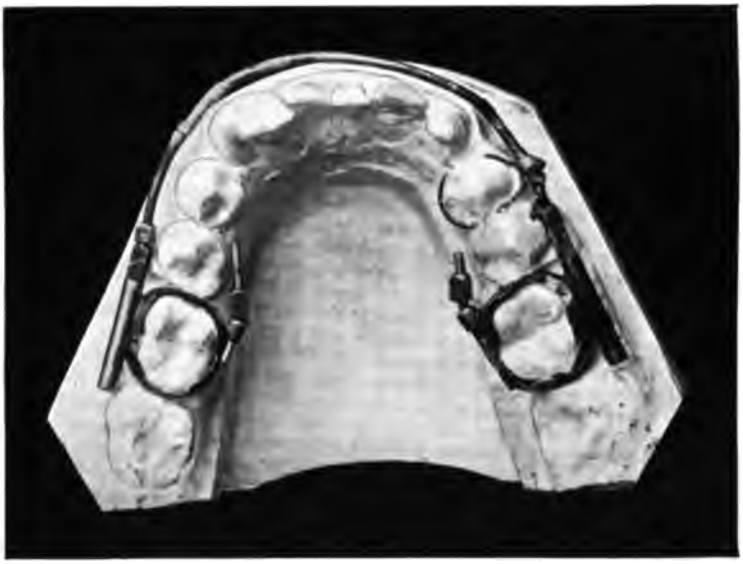

Fig. 238.
Spur soldered to arch to engage ligature which holds premolar to arch and causes it to move distally as a result of the intermaxillary anchorage.

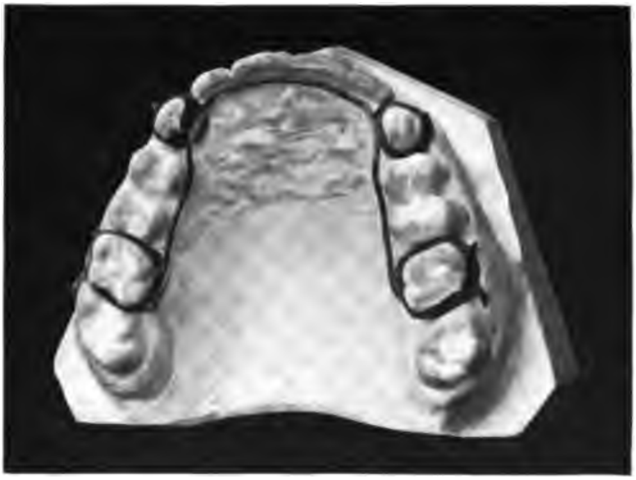

Fig. 239.
Upper retainer for Class III.

lars and premolars move distally, it is then possible to place wires on the canines and expand in the canine region. Spurs can be placed on the lower arch to such position as to exert a distal pull on those teeth. After the teeth are moved into the proper position, the upper teeth are retained by placing plain bands on the molars and premolars, with a wire soldered to the lingual surface of the bands. On the mesio-buccal angle of the molar bands (Fig. 239) a spur is soldered to engage the intermaxillary rubber to be used in retention. On the lower teeth plain bands are made for the molars and canines. A wire is placed on the labial side of the incisors and soldered to the labial surface of the canine bands, as shown in Fig. 240. A wire is soldered on the lingual side of the molars and canines. On the disto-labial angle of the canine band a spur is soldered, engaging the intermaxillary rubber which extends from the spur soldered to

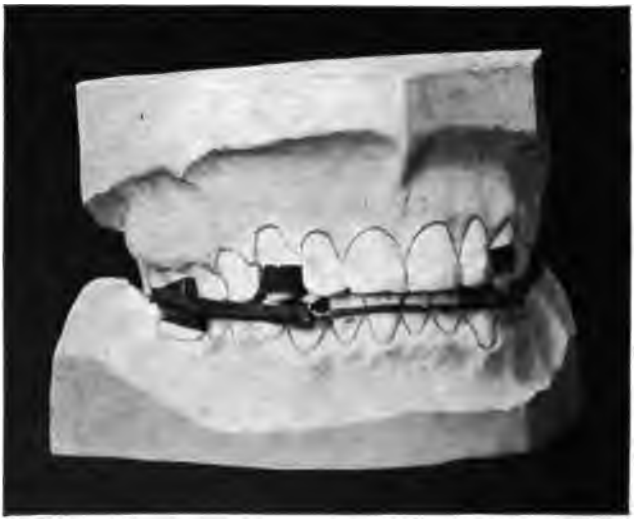

Fig. 240.
Showing intermaxillary retention of Class III.

the upper molar bands. The wearing of the intermaxillary rubbers maintains the mesio-distal relation of the teeth.

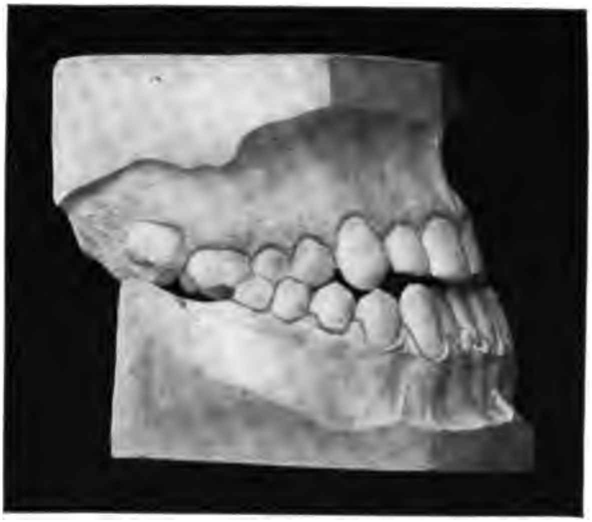

Fig. 241-A.

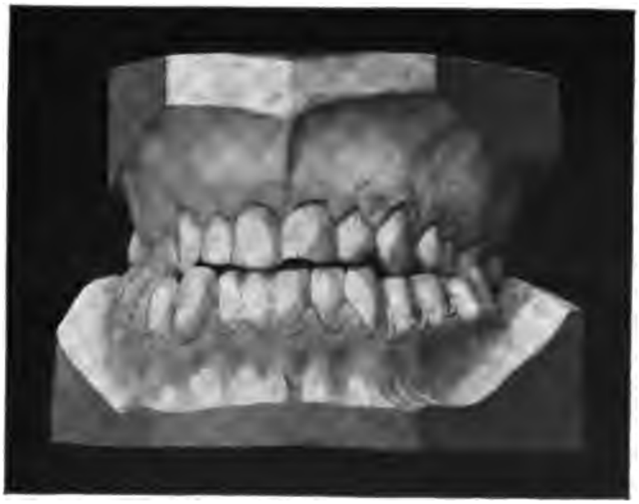

Fig. 241-B.
Class III case. Open-bite and narrow upper arch.

In the treatment of Class III cases, there is a great tendency to elongate the molars, both the upper and lower. However, the greater danger lies with the lower molars owing to the manner in which the stress is brought to bear on those teeth. Therefore, the teeth must not be moved too fast, as the slow movement of the teeth prevents the elongation.

Fig. 241 shows another case of Class III which was complicated by open-bite. An attempt had been made to correct the open-bite by extracting the second and third lower molars and grinding off the occlusal surface of the lower first molars. The lower molars are in buccal occlusion and the upper arch is slightly narrow. There is very little malocclusion of the upper teeth. The lower anterior teeth are slightly bunched and are inclining lingually. With the lingual inclination of the lower teeth it becomes necessary to move the apex of the teeth as well as the crowns, or the tipping will be more noticeable.

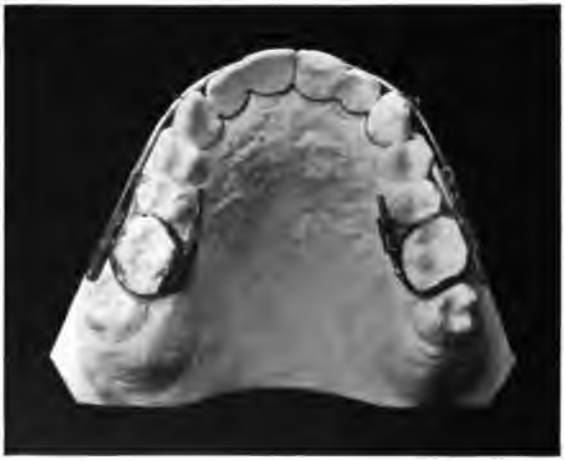

Fig. 242-A.
Upper teeth ligated to make stationary anchorage in molar region.

The expansion arch was placed on the upper teeth as shown in Fig. 242, all of the teeth being ligated to the arch in order to make the upper teeth as rigid as possible. As the lower molars were in buccal occlusion, the expansion arch was adjusted with a spring to the lingual in the molar regions. The relation of the ends of the expansion arch to the molar bands is shown in Fig. 242. When the expansion arch is inserted in the tubes on the molar bands, a lingual force will be exerted on the teeth which will narrow the distal portion of the dental arch. In putting on the expansion arch in the tubes where a lingual force is exerted on the molars, it is always necessary to tie the arch in place, for the lingual spring will throw the arch out of the tubes. While the lower molars are being moved lingually, the intermaxillary rubbers are worn from the hooks which were placed on the lower arch in the region of the canines to the tubes on the upper molar bands. After studying the case, it was decided to elongate the lower incisors in order to close the open-bite. Therefore, the lower ex-

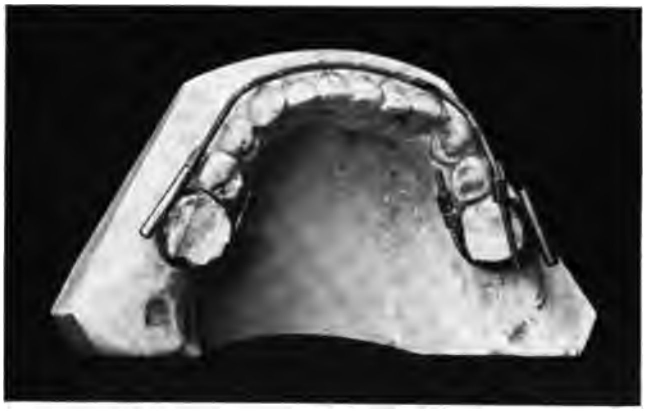

Fig. 242-B.
Shows how arch was bent to move lower molars lingually.

pansion arch occupied a position along the incisal border of the teeth. Wire ligatures were placed around the teeth and twisted tightly to prevent them from slipping over the gingival marginal ridge of the teeth; then the ends of the wires were brought around the arch and twisted. This springs the expansion arch gingivally and exerts a force on the lower teeth so as to elongate them. In order to keep the lower teeth in their upright position and move the apex of the teeth distally, spurs

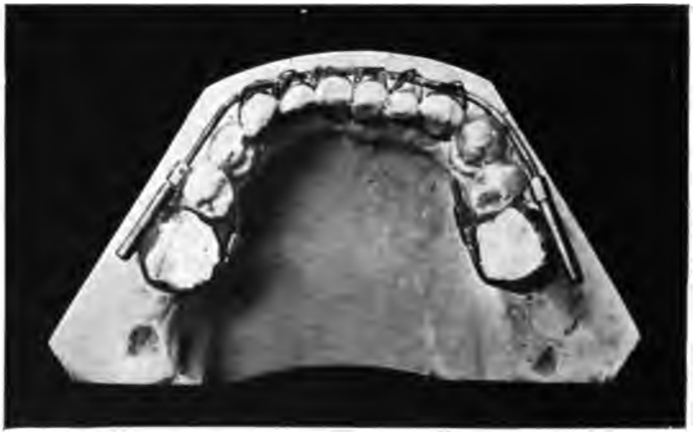

Fig. 242-C.
Ends of lower arch in tubes and ligated in place.

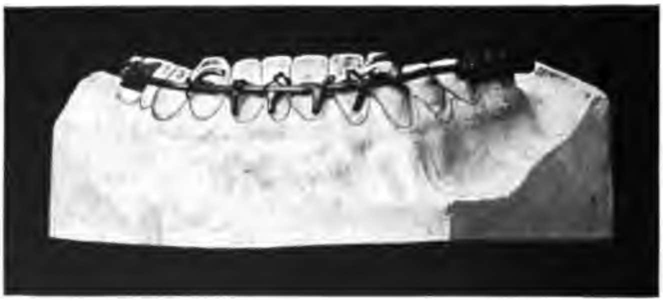

Fig. 243-A.
Showing spurs on lower arch to keep lower teeth upright.

are soldered to the lower arch, as shown in Fig. 243-A.

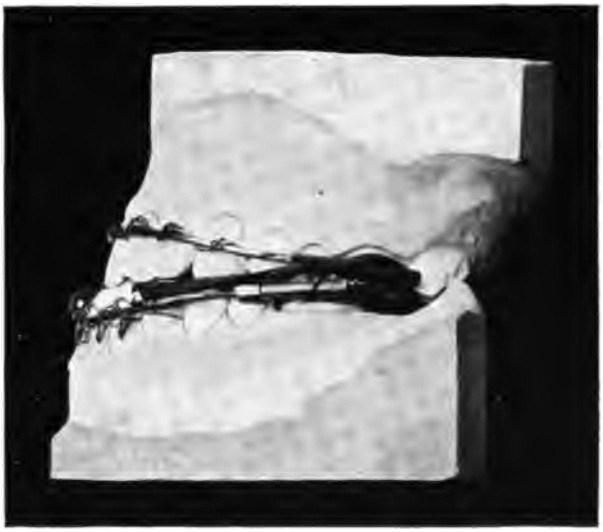

Fig. 243-B.
Side view with intermaxillary anchorage.

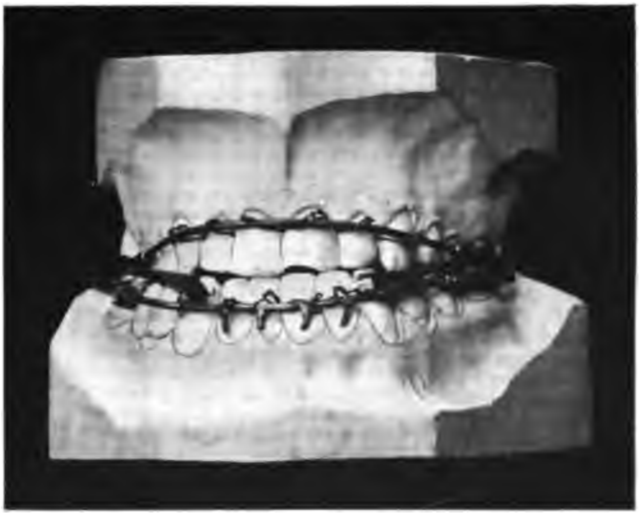

Fig. 243-C.
Front view with intermaxillary anchorage.

The lower anterior teeth should be elongated to very nearly the desired length before they are ligated to the

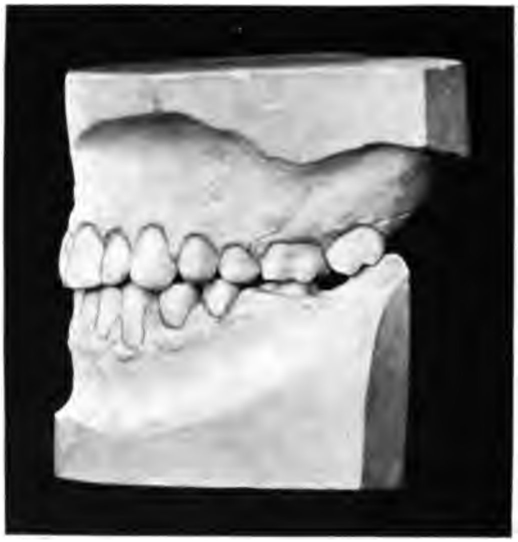

Fig. 244-A.

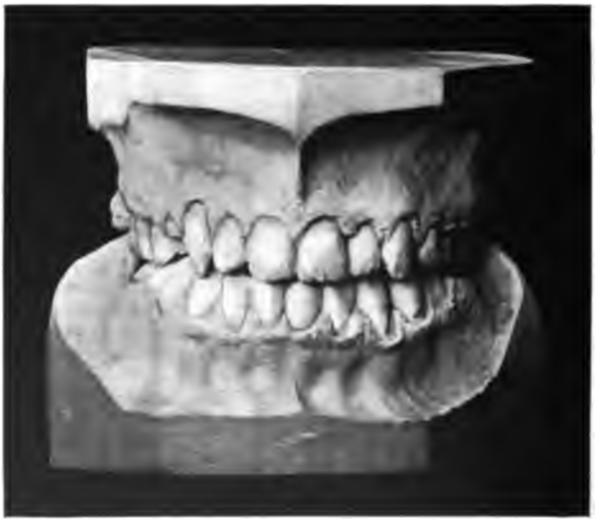

Fig. 244-B.
Result of treatment of case shown in Fig. 241.

arch and spur; for in order that the spur will be effective, it is necessary to use a plain ligature which will hold the tooth tightly to the spur. A small piece of rubber

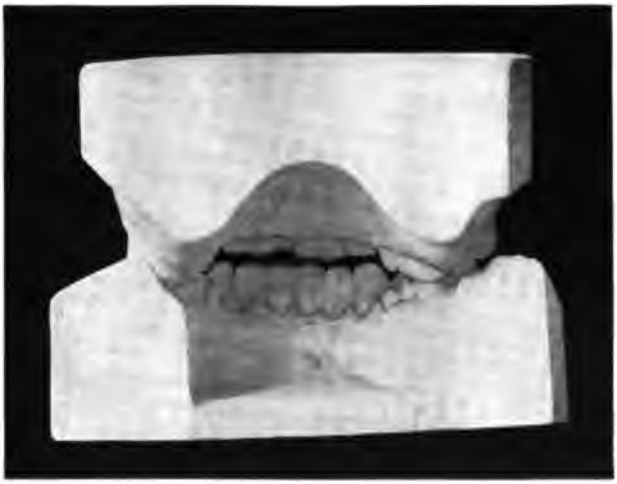

Fig. 245-A.

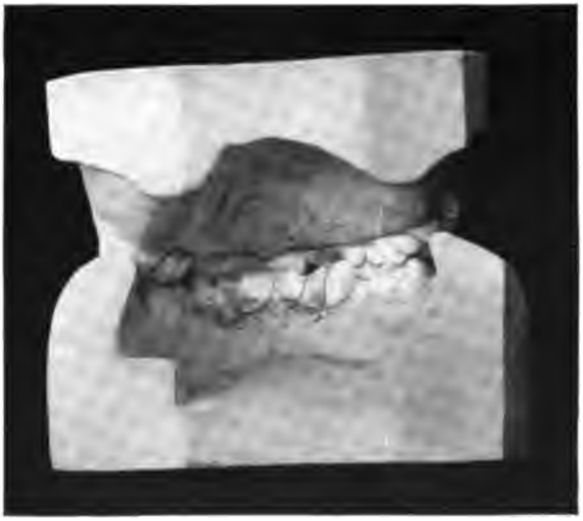

Fig. 245-B.

Showing effect of moving lower molars lingually. A, before treatment; B, after treatment.

can then be placed under the gingival end of the spur, and the apex of the teeth will be carried lingually. Fig. 244 illustrates the front and side view of the case at the time the regulating appliance was removed and a retainer placed on the teeth. The rear view (Fig. 245) shows how much the region of the lower molars was narrowed. The retaining appliances are the same as described in the previous case, with the addition of small spurs on the lingual side of the lower labial wire, which engages the approximal sides of the lower teeth. These spurs keep the teeth in their proper position, occluso-gingivally. Intermaxillary rubbers are worn to keep the teeth in their proper mesio-distal relation, extending from the spur on the upper first molars to the lower canines.

Class III, Subdivision.

Fig. 246 shows a case of the Subdivision of Class III. The dental arches are normal mesio-distally on one side, and mesial on the right. In looking at the front view of the case, it will be seen that the upper lateral incisors are in lingual occlusion. The palatal view (Fig. 247) shows great contraction or rather lack of development of the upper dental arch, all of the molars and premolars being in lingual occlusion.

In applying the expansion arch to the upper teeth, clamp bands are placed on the upper first molars after separation has been gained by the use of a ligature wire. The bands are so adjusted that the tubes will occupy a position which will enable the arch to lie near the gingival portion of the teeth. The expansion arch in the canine region is left rather square, as shown in Fig. 247, as the canines must be moved buccally. Soft solder spurs are placed on the arch buccally to the canines so

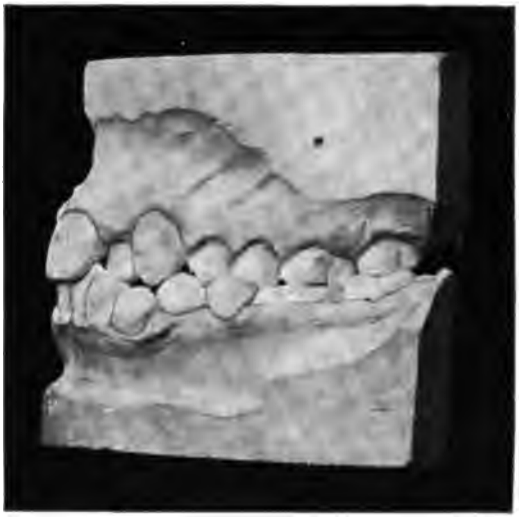

Fig. 246-A.
Side view of Class III, Subdivision case.

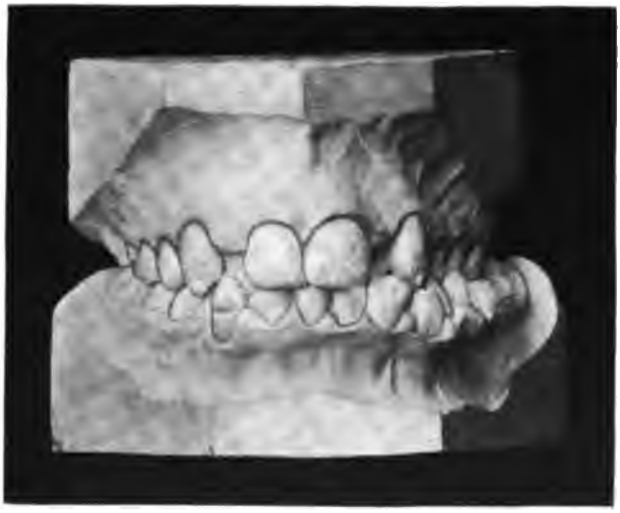

Fig. 246-B.
Front view of Class III, Subdivision case.

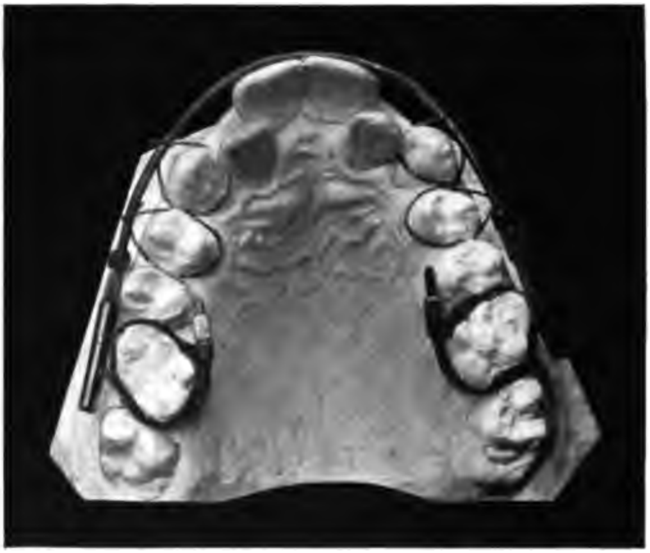

Fig. 247-A.
Occlusal view with upper arch adjusted.

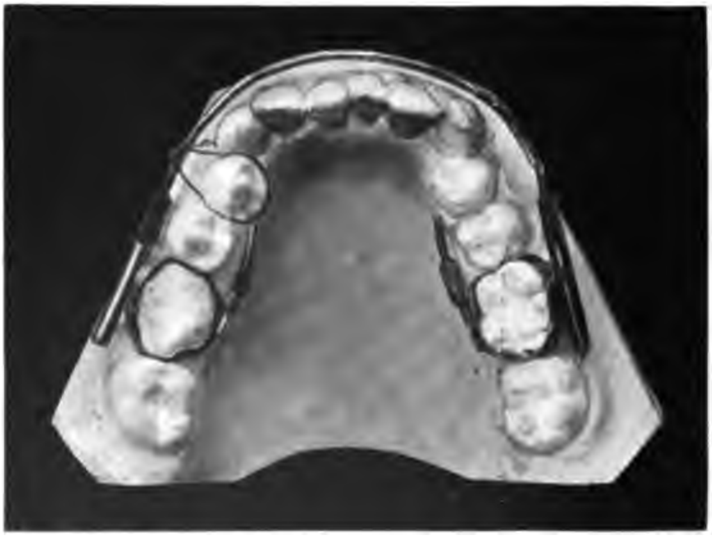

Fig. 247-B.
Occlusal view with lower arch adjusted.

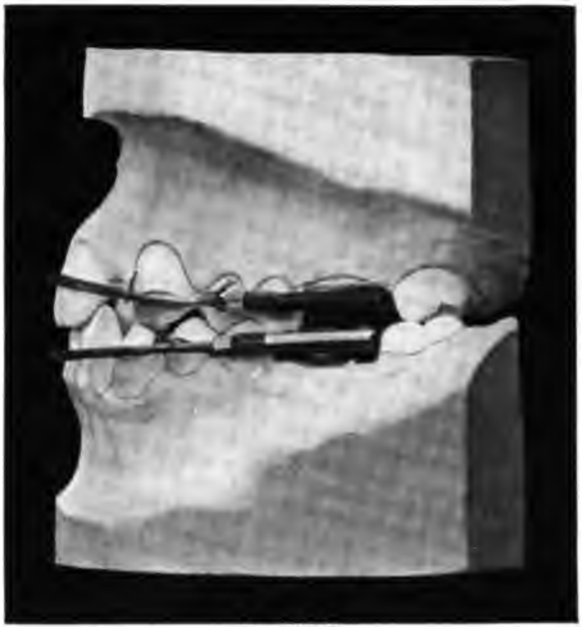

Fig. 247-C.

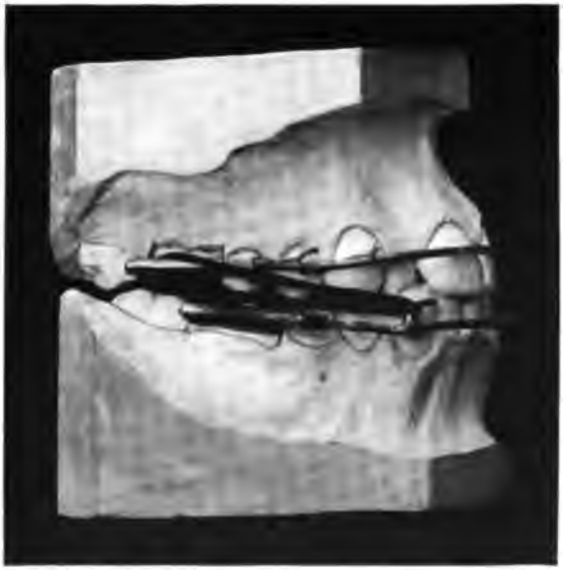

Fig. 247-D.

Side views showing intermaxillary anchorage used on mesial side of lower.

it will be possible to move these teeth directly buccally. Before the arch is placed in the tubes on the molar bands, the ends of the expansion arch should occupy a position to the tubes as shown in Fig. 248. If the distal portion of the arch is farther buccally to the tube than the mesial portion, the tooth will be rotated. The canines and premolars are ligated to the arch and after the canines have been moved slightly, or enough to make some space, the ligatures are placed on the laterals and they are moved into position.

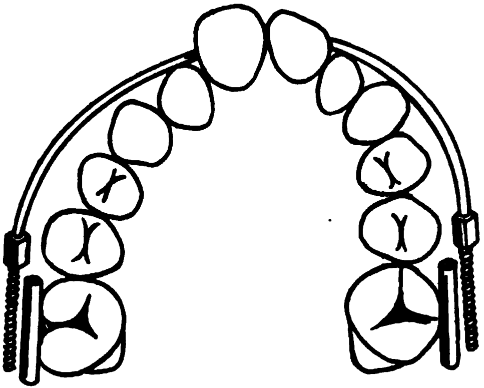

Fig. 248.
Application of arch to expand molars without rotating same.

Clamp bands are placed on the lower first molars and the tubes so placed that they will permit the arch to occupy a position near the gingival border of the teeth. As it is necessary to move the lower teeth on the right side distally, an intermaxillary-hook is soldered to the lower arch opposite the right canine. An intermaxillary-hook should also be placed on the left side of the arch opposite the canine, not to move the lower teeth distally, but to be used to reënforce the upper molar, for in moving the upper left lateral over the lower teeth the upper molar is sometimes forced distally. With the intermaxillary-hook on the lower arch, an intermaxillary rubber can be used to prevent such an occurrence. The anterior position of the lower expansion arch stands away from the teeth, and the intermaxillary ligatures exert all of the force on the lower right molar. No rubber ligature is placed on the left side, unless it is necessary to reënforce the upper molar anchorage. After the lower molars begin to move distally, if a space is developed between the molars and premolars, ligatures should be put on those teeth to move them distally after the manner described in the treatment of the full division. The author does not consider it at all advisable to allow the molars to be moved away from the premolars any distance; for it destroys the approximal contact of the teeth, destroys the fibres of the peridental membrane which runs from the cementum of one tooth to the cementum of the other, and makes retention more difficult. The lower right canine must also be moved in turn as the molars are moved. The author wishes it distinctly understood that he does not advocate starting all of the lower teeth on one side at once; but as soon as there has been sufficient tissue change around the molars so they will start to move, the premolars and the canine must have force brought to bear on them in order that they will move distal together and hold the teeth in their proper approximal relations. After the molars, premolars and canines have been moved to their proper place, or nearly so, the anterior lower teeth can then be moved to the desired position.

The retention of the upper teeth consists in the use of the plain bands on the first molars and canines with a lingual retaining wire soldered to the bands. On the mesio-buccal angle of the upper molar band, a spur is soldered which will engage a rubber ligature to be used for intermaxillary retention. The lower retainer in this case will consist of the same device (Fig. 240), except that on the lower right canine band a spur is soldered on the disto-labial angle to engage the intermaxillary rubber.

As the teeth become locked by the inclined planes and the approximal relation of the contact point, the wearing of the rubbers can be discontinued gradually.

Since the treatment of one case of the subdivision is very much the same as any other, these cases need not be discussed further here; however, it must be remembered that the cases of this particular type are generally progressive, and both the division and subdivision should receive early attention.

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